



*State
of the
Environment
For
Springfield and Greene County,
Missouri
2002*



Community Partnership
OF THE OZARKS, INC.



**STATE OF THE
COMMUNITY'S HEALTH
SPRINGFIELD/GREENE COUNTY, MISSOURI
2002**

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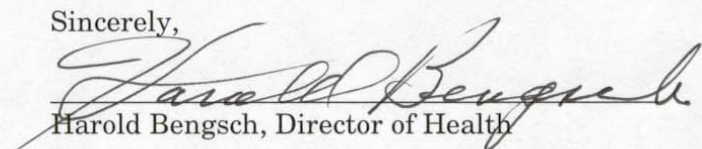
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Ann Hall, Chair, Springfield/Greene County Environmental Advisory Board
Tom Milne, Executive Director, National Association of County and City Health Officials (NACCHO)

It is a pleasure to transmit to you the "State of the Environment Report for Springfield / Greene County." This report is intended to provide not only policy and decision makers, but the citizens at large with information on this community pertinent to the health of its' environment.

Sincerely,


Harold Bengsch, Director of Health

--OVERVIEW--

This publication results from almost 18 months of devoted work by many individuals volunteering their time to evaluate the state of our community's environment.

It is a well known, but less well understood fact that many conditions relating to human health are both directly as well as indirectly linked to the environment in which we live, work, learn, and play. It therefore follows, that for a community to effectively address the improvement of its health status, attention must include the health of its environment.


In 1996, working with the Health Collaborative of the Community Partnership of the Ozarks (CPO), the Springfield/Greene County Department of Public Health and Welfare published the *"State of the Community's Health Springfield/Greene County."* After a period of time following distribution of the report, community hearings were conducted to gather information leading to a consensus set of focus areas for community health improvement. That process resulted in ten areas of focus.

Over the ensuing years, a national effort led by the National Association of County and City Health Officials (NACCHO) developed the community environmental assessment guidance document, known as the *"Protocol for Assessing Community Excellence in Environmental Health" (PACE EH)*. Utilizing that document, the Health Department called upon the Environmental Collaborative of the CPO to partner in this community-wide assessment effort. Barbara Lucks, Chair of the Environmental Collaborative, led that organization to agree to partner with the Health Department in this effort. At the Collaborative meeting in October 2000, the PACE EH process began. The national pilot tests on this process found an average time requirement of 18 months to two years for performing the assessment. Working with Ms. Lucks and members of the Collaborative were Clay Goddard, Community/Environmental Health Planner, and Cory Baker, Health Planning Intern of the Health Department. Springfield/Greene County is the first community in Missouri to conduct this comprehensive assessment. Although developing and publishing this report has required great effort and dedication on the part of those involved, the real work has just begun.

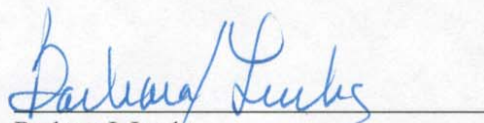
Now attention must be directed toward determining the focus areas for environmental health improvement, selection of the consensus set of indicators and finally establishment of work groups focusing on the improvement strategies and processes. This report should serve as a valuable resource to those efforts. To assist in the selection process, a draft set of indicators is included within the body of the report.

So that the community can gauge progress on efforts toward improving its health status, the Health Department publishes each April, a Community Health Report Card. Key community health indicators are benchmarked and displayed over a five-year rolling average together with the current year's data compared to the same data for the State. It is the Health Department's intent to develop a similar report card on the environment to serve the same purpose.

Now, it is the community's turn to roll up its sleeves and get involved in both helping preserve and enhance the health of our environment, which is so critical to the great quality-of-life of this community. As a first step, please read this report and reflect on the information it contains. Then, ask yourself this question—*What part can I play in preserving and yes, improving the environment in which I live?* In so doing you can become involved as a steward in preserving our environmental legacy for future generations.



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Chair—Environmental Collaborative
Community Partnership of the Ozarks

ACKNOWLEDGEMENTS

The completion of this environmental health assessment involved many persons, organizations, and agencies. Sincere appreciation goes out to the following groups instrumental in the research and development of this environmental health assessment:

City of Springfield's Planning Department

City of Springfield's Public Works Department

City Utilities of Springfield

Community/Environmental Health Planning Staff led by Clay Goddard and Cory Baker who developed the format and provided the research for this document

Drury University

Environmental Collaborative of the Community Partnership of the Ozarks

The Forrester Group

Greene County Prosecuting Attorney's Office

Greene County Sheriff's Department

The James River Basin Partnership

Missouri Department of Conservation

Ozark Greenways

Missouri Department of Natural Resources

Southwest Missouri State University

Springfield-Greene County Health Department

United States Department of Agriculture

United States Drug Enforcement Administration

The Watershed Committee of the Ozarks

FOREWORD

Protecting and preserving environmental health are important concerns since good environmental health is a cornerstone of public health. The objective of this document is to assess the environmental health of Springfield and Greene County. In addition to serving as a status report of our County's health, this community-based environmental health assessment will assist decision makers in the formulation of environmental programs and policies aimed at improving the environmental health of Greene County and its communities. The assessment was assembled through a collaboration of the general public and officials from the public, private, and not-for-profit sectors at various levels and from various disciplines. Also, the collaborative process has provided strong networking opportunities among participants. As a result, new coalitions and ideas have formed that will prove beneficial in the development and creation of future community environmental projects and programs.

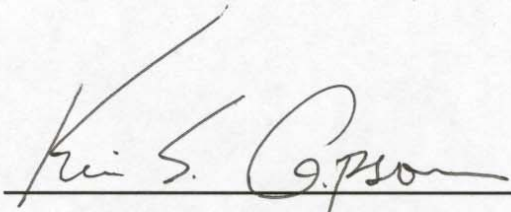
This environmental health assessment is a project of the Springfield-Greene County Health Department. The data and information used in this assessment were compiled through research of both electronic and standard published materials. A great deal of information was also obtained through personal interviews with contacts in many environmental disciplines. These disciplines include: population growth and urban sprawl, water, air, solid waste management, community health, and environmental education and environmental justice. Fittingly, these issues comprise the six chapters of this assessment.

The completion of an undertaking such as this assessment entails a great deal of planning. Recognizing the need for a plan to complete the process of developing a large-scale environmental health assessment, the *Protocol for Assessing Community Excellence in Environmental Health (PACE EH)* became the chosen methodological framework. Thirteen tasks comprise the assessment process outlined in *PACE EH*. In developing this document, the Springfield-Greene County Health Department has observed the protocol suggested by *PACE EH*. The thirteen tasks delineated by *PACE EH* are:

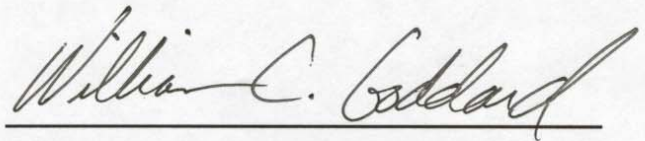
- Task One: Determine Community Capacity to Undertake the Assessment
- Task Two: Define and Characterize the Community
- Task Three: Assemble a Community-Based Environmental Health Assessment Team
- Task Four: Define the Goals, Objectives, and Scope of the Assessment
- Task Five: Generate a List of Environmental Health Issues
- Task Six: Analyze the Issues with a Systems Framework
- Task Seven: Develop Locally Appropriate Indicators
- Task Eight: Select Standards Against Which Local Status Can be Compared
- Task Nine: Create Issue Profiles
- Task Ten: Rank Issues
- Task Eleven: Set Priorities for Action
- Task Twelve: Develop an Action Plan
- Task Thirteen: Evaluate Progress and Plan for the Future

Each of the six chapters in this assessment opens with several environmental quotations and a section entitled “Did You Know?” The “Did You Know?” sections provide miscellaneous facts and figures pertaining to the subject of each chapter. Also, each chapter provides a reference sheet of data sources by which additional research may be conducted. Data sources are also listed under chapter tables and figures. The concluding chapter of this assessment identifies several indicators important to the environmental health of Springfield and Greene County. These indicators, along with others to be determined by the community, will be measured and tracked in an annually published environmental report card.

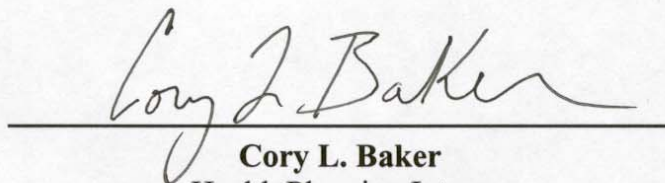
The appendix to the assessment contains the Springfield Area Directory of Environmental Agencies and Organizations. The directory provides information about government agencies, as well as not-for-profit and member-based organizations serving Springfield and Greene County. These agencies and organizations serve instrumental roles in many environmental areas. The directory contains contact information and descriptions of each agency/organization.



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SPRINGFIELD AND GREENE COUNTY

**POPULATION, GROWTH, AND
URBAN SPRAWL**

The best remedy for those who are afraid, lonely or unhappy is to go outside, somewhere where they can be quiet, alone with the heavens, nature and God. Because only then does one feel that all is as it should be and that God wishes to see people happy, amidst the simple beauty of nature. As long as this exists, and it certainly always will, I know that then there will always be comfort for every sorrow, whatever the circumstances may be. And I firmly believe that nature brings solace in all troubles.

~ Anne Frank

To find the universal elements enough; to find the air and the water exhilarating; to be refreshed by a morning walk or an evening saunter; to be thrilled by the stars at night; to be elated over a bird's nest or a wildflower in spring - these are some of the rewards of the simple life.

~ John Burroughs

Because we don't think about future generations, they will never forget us.

~Henrik Tikkanen

The sun, the moon and the stars would have disappeared long ago... had they happened to be within the reach of predatory human hands.

*~Havelock Ellis, *The Dance of Life*, 1923*

Did You Know?

- **Greene County had a 2000 population of 240,391.**
- **From 1990 to 2000, Greene County's population increased by 15.6%.**
- **The median age for Greene County in 2000 was 35.1 years of age, up from 32.6 years of age in 1990.**
- **Farms in Greene County have declined at a rate of about 23 per year since 1900.**
- **Well-positioned trees can reduce energy costs by as much as 25 percent.**
- **Nearly one and a half million passengers used City Utilities' bus transit system in 2000.**
- **Six Brownfield sites have been identified in the Jordan Creek Corridor of the Springfield downtown area.**

Introduction

Projections by the U.S. Census Bureau show the City of Springfield to be one of the fastest growing metropolitan areas in Missouri. As the population of Springfield increases, various concerns arise related to urban sprawl. Urban sprawl is the unplanned, uncontrolled spreading of urban development into areas adjoining the edge of a city. Concerns over sprawl convinced City and County officials that a plan was needed in order to effectively prepare for increased growth. The result was the 1996 Springfield-Greene County Comprehensive Plan, or Vision 20/20. Vision 20/20 is a citizen-based, 25-year plan for the future growth and improvement of Springfield and Greene County. Objectives of Vision 20/20 include pollution prevention, improved quality of life, preservation of historic sites, creation of parks and green spaces, and redevelopment of brownfield sites in downtown Springfield.

This chapter presents information concerning issues of population and growth/urban sprawl in Springfield and Greene County. The topics discussed in this chapter are as follows: population trends; gender, race, and age composition; housing data; utility information; loss of farmland; bicycle lanes, greenways, and trails; urban forests and tree canopy decline; the bus transit system; urban sprawl and health; and brownfields.

The number of issues related to growth are seemingly limitless. By no means does this chapter present an exhaustive list of growth-related issues. Several issues related to growth and sprawl (e.g., air and water quality) not found in this chapter may be found in other chapters of this environmental health assessment. The growth issues assessed in this chapter have been determined to be of current priority in Springfield and Greene County.

Greene County Population Trends

Tables 1-1 and 1-2 below show population trends in Greene County and Missouri since 1950. The first table presents actual population figures and the second table shows the percent change in population by decade. Actual populations for both Greene County and Missouri continue to increase every year. The growth rate of Greene County's population, as indicated in the second table, has outpaced that of the State's by an average of nearly eleven percent over the fifty year period.

Table 1-3 presents Greene County population projection figures, in five-year increments, from 2000 through 2025. The projection figures in Table 1-3, provided by the Missouri Office of Social and Economic Data Analysis, are based upon high fertility rates, low mortality rates, and Greene County's highest historic migration rate. Because projection numbers using actual 2000 census figures are not yet available, a projection model was chosen that most closely approximates current population figures. In this case, an aggressive projection model was used as evidenced by the selection of high fertility rates, low mortality rates, and the County's highest migration rate.

Similar population projection figures were given in the *Land Use and Growth Management* document written by the City of Springfield's Planning and Development staff (approved by City Council in June 2001). The planning document projected that the Greene County population, by the year 2020, will range from 285,000 to 300,000 persons. To accommodate this growth, the Planning and Development staff predicts that 40,000 to 45,000 additional housing units will be needed, along with 11,200 acres of unoccupied land.

Table 1-4 compares population data from 1990 and 2000 for Greene County municipalities. Strafford and Battlefield experienced the greatest growth in population while Springfield experienced the least growth. Most of Rogersville is located in Webster County, hence the low population figures for the Greene County portion shown in Table 1-4.

Table 1-1
Population Trends in Greene County and Missouri, 1950-2000

	1950	1960	1970	1980	1990	2000
Greene County	104,823	126,276	152,929	185,302	207,949	240,391
Missouri	3,954,653	4,319,813	4,677,229	4,916,766	5,117,073	5,595,211

Source: U.S. Bureau of the Census, 2000

Table 1-2
Percent Change in Population for Greene County and Missouri, 1950-2000

	1950-1960	1960-1970	1970-1980	1980-1990	1990-2000
Greene County	20.5%	21.1%	21.2%	12.2%	15.6%
Missouri	9.2%	8.3%	5.1%	4.1%	9.3%

Source: U.S. Bureau of the Census, 2000

**Table 1-3
Greene County Population Projections, 2000-2025**

	2000	2005	2010	2015	2020	2025
Greene County	240,391	250,628	263,944	277,279	290,708	303,972

Source: Office of Social and Economic Data Analysis, 2000

**Table 1-4
Greene County Population
by Municipality**

Municipality	Population 1990	Population 2000	Percent Change
City of Ash Grove	1,128	1,430	26.8%
City of Battlefield	1,526	2,385	56.3%
Brookline Village	283	326	15.2%
City of Fair Grove	919	1,107	20.5%
City of Republic	6,292	8,438	34.1%
City of Rogersville	21	29	38.1%
City of Springfield	140,494	151,576	7.9%
City of Strafford	1,166	1,845	58.2%
City of Walnut Grove	549	630	14.8%
City of Willard	2,177	3,193	46.7%

Source: Office of Social and Economic Data Analysis University of Missouri System, 2000

Greene County Gender, Race, and Age Composition

As evidenced by the data in Table 1-5, females outnumbered males in the County by three percent in 2000. Tables 1-6, 1-7, and 1-8 compare population data in Greene County and Missouri for the following races: White, African American, American Indian/Alaskan Native, Asian, and Native Hawaiian/Pacific Islander. It should be noted that the last column in Table 1-8, *Persons of Hispanic/Latino Origin*, includes persons of any race. Table 1-8 does not include data for *Native Hawaiian/Pacific Islander, Other, and Persons Reporting Two or More Races* due to changes in the Census Bureau's reporting methods that affected these categories.

Table 1-5
Gender Composition of Greene County Population, 2000

	Number	Percent of Population
Males	116,703	48.5%
Females	123,688	51.5%

Source: U.S. Bureau of the Census, 2000

Table 1-6
County and State Race
Populations, 2000

	White	African American	American Indian/ Alaskan Native	Asian	Native Hawaiian/ Pacific Islander	Other	Persons Reporting Two or More Races
Greene County	224,859	5,426	1,583	2,720	145	1,617	4,041
Missouri	4,748,083	629,391	25,076	61,595	3,178	45,827	82,061

Source: U.S. Bureau of the Census, 2000

Table 1-7
Percent of County and State
Race Populations, 2000

	White	African American	American Indian/ Alaskan Native	Asian	Native Hawaiian/ Pacific Islander	Other	Persons Reporting Two or More Races
Greene County	93.5%	2.3%	0.7%	1.1%	0.1%	0.7%	1.7%
Missouri	84.9%	11.2%	0.4%	1.1%	0.1%	0.8%	1.5%

Source: U.S. Bureau of the Census, 2000

Table 1-8
Percent Increase in Greene County
Race Populations, 1990-2000

	White	African American	American Indian/ Alaskan Native	Asian	Native Hawaiian/ Pacific Islander	Other	Persons Reporting Two or More Races	Persons of Hispanic/ Latino Origin
Greene County	11.9%	44.7%	23.6%	78.6%	N/A	N/A	N/A	1.8%

Source: U.S. Bureau of the Census, 2000

Table 1-9 below presents age composition data for Greene County in the year 2000. The 35 to 44 year old group constituted the highest percentage of the total population in Greene County. The median age for residents of Greene County is 35.1 years.

Table 1-9
Age Composition of Greene County Population
for 2000

Age Range	Number	Percent of Total Population
Under 5 Years	14,699	6.1%
5 to 9 Years	14,806	6.2%
10 to 14 Years	14,888	6.2%
15 to 19 Years	18,662	7.8%
20 to 24 Years	23,691	9.9%
25 to 34 Years	33,067	13.8%
35 to 44 Years	35,586	14.8%
45 to 54 Years	31,665	13.2%
55 to 59 Years	11,453	4.8%
60 to 64 Years	9,206	3.8%
65 to 74 Years	16,414	6.8%
75 to 84 Years	11,699	4.9%
84 Years and Over	4,555	1.9%
Total Population 240,391		
Median Age 35.1		

Source: U.S. Bureau of the Census, 2000

Housing

The following two tables present housing data in Greene County for the year 2000. An understanding of housing trends is important as it allows us to better understand the community as a whole. Table 1-10 shows various information concerning household type and Table 1-11 provides housing data by unit type.

Table 1-10
Greene County Housing Data
by Household Type, 2000

Type of Household	Number	Percent
Family Households	61,837	63.2%
With Own Children Under 18 Years	27,726	28.3%
Married Couple Family	48,961	50.0%
With Own Children Under 18 Years	19,820	20.3%
Female Householder (No Husband Present)	9,569	9.8%
With Own Children Under 18 Years	5,971	6.1%
Non-Family Households	36,022	36.8%
Single Householder	28,482	29.1%
Householder 65 Years and Over	9,528	9.7%
Households with Individuals Under 18 Years	29,866	30.5%
Total Households	97,859	100%

Source: U.S. Bureau of the Census, 2000

Table 1-11
Greene County Housing Data
by Unit Type, 2000

Type of Housing Unit	Number	Percent
Occupied Housing Units	97,859	93.6%
Owner Occupied	62,225	59.5%
Renter Occupied	35,634	34.1%
Vacant Housing Units	6,658	6.4%
Vacant for Rent	2,752	2.6%
Vacant for Sale	1,441	1.45
For Seasonal, Recreation or Occasional Use	367	0.4%
Total Housing Units	104,517	100%

Source: U.S. Bureau of the Census, 2000

Utilities

City Utilities of Springfield has provided, in its 2002 Long Range Plan, figures on customer growth and use projections for electricity, natural gas, and water resources. The Long Range Plan covers fiscal years 2002-2006. Table 1-12 below indicates the projected percent increase expected in customer growth over the period 2002-2006 for electricity, natural gas, and water resources. The data is separated into residential and non-residential customer categories. Table 1-13 shows the percent increase/decrease in customer use of electricity, natural gas, and water resources over the period as projected by City Utilities. The data in Table 1-13 has also been separated into residential and non-residential customer categories.

Table 1-12
Percent Increase in Utility Customer Growth
Fiscal Years 2002-2006

	Residential	Non-Residential
Electricity	1.50%	1.80%
Natural Gas	1.40%	1.80%
Water	1.60%	1.80%

Source: City Utilities of Springfield, 2001

Table 1-13
Percent Increase (Decrease) in
Utility Customer Use
Fiscal Years 2002-2006

	Residential	Non-Residential
Electricity	1.00%	2.00%
Natural Gas	(0.60%)	0.00%
Water	0.50%	0.70%

Source: City Utilities of Springfield, 2001

Loss of Farmland in Greene County

Urban sprawl is unplanned, uncontrolled spreading of urban development into areas adjoining the edge of a city. The continued increase in Greene County's population (evidenced in Tables 1-1, 1-2, and 1-3 at the beginning of this chapter) has contributed not only to growth and sprawl, but to a resultant decline of farms and farmland. Additional factors that could likely impact farm numbers include increases in land prices and reduced profitability of farming.

While the definition has likely changed over time, the United States Census of Agriculture defines a farm (in 1997) as a place that produced and sold at least \$1,000 of agricultural products. Table 1-14 presents figures for both the number of farms and the number of acres of farmland in Greene County from 1900 to 1997. Table 1-15 compares data on the loss of farms and the loss of farmland acreage in Greene County for the periods 1900-1997 and 1987-1997. The number of farms declined at a rate of about 23 per year for both periods. From 1900 to 1997, farmland acreage declined at a rate of about 948 acres per year, while this figure increased to 1,250 acres lost per year for the period 1987-1997.

Table 1-14
Greene County Farm Data
1900-1997

	Number of Farms	Acres of Farmland
1900	4,320	369,021
1910	4,434	385,314
1920	4,252	384,294
1930	4,473	371,909
1940	4,357	362,885
1950	3,982	368,020
1959	2,912	329,160
1969	2,301	307,140
1978	2,049	308,486
1982	2,275	300,519
1987	2,232	289,545
1992	2,103	285,496
1997	1,997	277,043

Source: U.S. Census of Agriculture

Table 1-15
Greene County Farm Data
1900-1997

	Actual Decrease in Farms	Percent Decrease in Farms	Actual Decrease in Farm Acreage	Percent Decrease in Farm Acreage
1900-1997	2,323	53.8%	91,978	24.9%
1987-1997	235	10.5%	12,502	4.3%

Source: U.S. Census of Agriculture

Bicycle Lanes, Greenways, and Trails in Greene County

An ongoing community concern related to increased urban sprawl is the concomitant decline in fitness levels. As people migrate to the outskirts of a city, they distance themselves from work, schools, and stores. Naturally, people become increasingly dependent on automobiles and are less likely to walk or bike. National health trends indicate the pervasiveness of this sedentary lifestyle, which could likely be reduced through increased levels of activity gained by developing methods that promote less reliance on automobiles for transportation. These issues are discussed below.

According to the *Surgeon General's Report on Physical Activity and Health*, 60 percent of Americans are not active on a regular basis, while 25 percent are not active at all. According to an article in the *American Journal of Preventive Medicine*, women and people of lower socioeconomic status are at higher risk of becoming inactive. Statistics on children have especially shown a decrease in activity levels. It is estimated that only about ten percent of American children between five and fifteen years of age walk to school, down from 50 percent in the 1960s. It has been reported that 25 percent of morning vehicle trips are parents driving children to school. According to the *Bicycle Advocacy Report Card*, approximately 35 percent of American children are clinically obese.

Safety concerns may be one rationale for decreased fitness levels in children. Many parents today worry about their kids walking or biking to school because of increased traffic or criminal activity. In an attempt to calm fears of crime and abduction, the *Bicycle Advocacy Report Card* indicates that abduction rates are currently at the lowest since 1960. The Centers for Disease Control and Prevention recommends several strategies to increase the numbers of kids walking to school and to calm worrisome parents. Some of these strategies are: have parents take turns walking neighborhood kids to school; have local public officials walk school routes to determine safety hazards; and, have buses drop off groups of kids to walk the remaining few blocks to school.

Other methods have been explored in many cities that focus on ways to increase and promote opportunities for residents to exercise. One example in Springfield is the creation of bicycle lanes on automobile roadways. Bicycle lanes, which are created by either striping or widening existing roads, provide bicyclists greater mobility and safety in urban areas. Another effective method is increased development of greenways and trails. Greenways are recreational spaces that typically follow natural land or water features such as forests or streams. Many trails are developed from out-of-commission manmade structures, such as abandoned railroad rights-of-way. Some greenways have trails for walking, running, bicycling, and other forms of recreation. In some areas, people are able to commute to work via such trails. Because they are more scenic and safe than city streets, trails and greenways are an effective way to promote physical activity.

The local organization Ozark Greenways is “a citizen’s group dedicated to the preservation of greenspace through creation of linear parks.” There are five trails/greenways offered by Ozark Greenways: the Frisco Highline Trail, the Sac River Trail, the Volunteer Nature

Trail, the Galloway Creek Greenway, and the South Creek/Wilson Creek Greenway. For more information about these trails and related recreational activities, Ozark Greenways may be contacted at (417) 864-2014.

Urban Forests and Tree Canopy Decline

Many adverse environmental impacts are associated with increased sprawl and growth. One major impact of concern in Greene County is the loss of trees in the urban area. Tree canopy decline is often a result of population growth and development. Trees provide many important economic, environmental, sociological, and health benefits. Urban forests are aesthetically appealing to residents and visitors alike. A Colorado study on the benefits of urban forests indicated that trees attract more businesses and tourists into an area. Residences and offices in wooded areas tend to have higher occupancy rates as well. Depending on the species, maturity, quantity, and location, trees can raise property values five to fifteen percent. This section discusses several benefits of urban forests, Springfield's *City Tree Inventory*, and the National Arbor Day Foundation's *Tree City, USA* program.

Benefits of Urban Forests

The economic benefits provided by urban forests are numerous. The U.S. Forest Service has estimated that well-positioned trees can increase energy savings by as much as 25 percent. Trees reduce energy consumption because they transpire water, provide shade, and block winter winds. Localities are provided further economic benefits by urban forests because shade trees extend the life of streets and defer maintenance by as much as ten to fifteen years. A study by the USDA Forest Service showed that the benefits produced by one large tree are about \$111 per year. Following is a breakdown of the annual cost benefits. One tree can:

- Reduce total annual air conditioning costs by about nine percent.
- Absorb ten pounds of air pollutants, including four pounds of ozone and three pounds of particulate matter. The value of this pollutant uptake is \$45. The amount of nitrogen oxide absorbed is equivalent to the amount emitted by a typical car driven 3,600 miles.
- Intercept 760 gallons of rainfall, reducing both runoff of polluted stormwater and flooding. The value of this water quality management and stormwater control is \$6.
- Clean 330 pounds of carbon dioxide and 90 pounds of carbon from the atmosphere. The value of this benefit is \$5. The amount of carbon dioxide removed from the atmosphere is equivalent to the amount emitted by a typical car driven 500 miles.
- Add about one percent to the sale price of property, or about \$25 each year over a 40-year period, based on a median residential property sales price of \$100,000.

Trees, especially those along city streets, require maintenance and upkeep. The costs associated with such maintenance, however, are well worth it. Officials with Springfield's Public Works Department estimate that the City spends \$30 per year to maintain a street tree. Springfield has approximately 15,000 street and open-space trees. Based on these figures and the savings presented in the USDA study, it is estimated that the City of Springfield receives an annual return of \$3.62 for every one dollar it invests in trees.

Trees provide several environmental benefits to urban areas as well. According to the USDA Forest Service, a study on the tree canopy in Salt Lake City showed that in a one inch rainfall over twelve hours, surface runoff was reduced by 17%. In addition to reducing surface runoff and soil erosion, trees remove nutrients from the soil that can, in excessive amounts, stress water quality (e.g., phosphorous and nitrates). Trees also provide excellent wildlife habitat.

Many of the sociological benefits of urban forests are obvious. One example is the relaxing environment created through their aesthetic qualities. Urban forests provide some not-so-obvious sociological benefits as well. For instance, tree-lined streets serve a public safety function as a traffic-calming mechanism. People are often tempted to drive faster on wide-open streets because their sight is not as limited. When streets are lined with trees, though, traffic will slow down because sight distances are limited and roadways seem more narrow. Another sociological benefit urban forests provide is the ability to block sound and decrease noise pollution.

City Tree Inventory

The *City Tree Inventory* was a study completed by the Public Works Department in 2001 to determine the health of trees along Springfield parkways. According to this study, 52 percent of Springfield's tree population is in fair condition, 18 percent is in good condition, and 28 percent is in poor condition. Less than one percent of the City's trees are in very good or excellent condition. The study points out that deforestation is occurring in both the inner and outer areas of the City. Dutch Elm Disease has killed over 5,000 trees in Springfield over a 40 year period. An additional 6,000 trees were lost as a result of storms, drought, disease, and old age. Even with replanting efforts, Public Works estimates total losses of Springfield's trees at approximately 40 percent. Based on the figures from the aforementioned USDA report, Public Works equates this loss to a reduction of over \$1.2 million in the City of Springfield's quality of life.

Tree City USA

One way communities are working to improve their urban forests is by applying for *Tree City USA* recognition. Two municipalities in Greene County, Springfield and Willard, have achieved the status of *Tree City USA*. Springfield has been a "Tree City" for 16 years and Willard for 3 years. There are many benefits to achieving "Tree City" status. Some of these benefits include: assistance in providing a framework for tree resource management; increased citizen and community pride; indication to visitors (demonstrated by *Tree City USA*

signs along a city's roads) that a community cares about its environment and that its quality of life may be better; and preference given to "Tree Cities" for environmental grants.

The National Arbor Day Foundation and National Association of State Foresters require municipalities to meet four standards in order to achieve *Tree City USA* status:

- (1) Establishment of a tree board or department
- (2) Establishment of a tree care ordinance
- (3) Establishment of a community forestry program with an annual budget of at least \$2 per capita
- (4) Establishment of an Arbor Day Observance and Proclamation

Bus Transit System

City Utilities operates two bus systems, a fixed-route system and a paratransit system for disabled patrons. Both bus systems run seven days a week, 365 days a year, from 6:00 am to midnight. City Utilities' current fleet is made up of 28 buses. The number of passengers increased ten percent last fiscal year to approximately 1.45 million passengers. According to City Utilities, 35% of their passengers are elderly or disabled, 63% are from low income households, and 52% use the system for transportation to and from work.

City Utilities recently added bicycle racks (with a carrying capacity of two bicycles) to the front of each bus. In an attempt to promote the use of the bicycle racks, City Utilities sponsored Bike-to-Work Week from May 20th through May 26th of 2001. As the sponsor, City Utilities gave free bus rides to anyone at a bus stop with a bicycle. By week's end, a total of 324 bicycle-riding patrons had taken advantage of the offer. The purpose of adding the racks to the buses was to promote healthier, environment-friendly alternative methods of transportation to work. The racks offer an additional convenience to customers with bicycles.

Table 1-16 shows the total number of bus passengers from 1995 to 2000. As shown in the table, bus ridership was at its highest in 2000. Table 1-17 shows total hours of bus operation, total bus miles driven, and average number of passengers per hour for fiscal year 2000.

Table 1-16
City Utilities Bus Ridership from 1995-2000

	1995	1996	1997	1998	1999	2000
Total Passengers	1,300,228	1,241,692	1,052,353	1,180,445	1,366,387	1,437,995

Source: Springfield City Utilities

Table 1-17
City Utilities Bus Summary Data
Fiscal Year 2000

	2000
Total Hours	81,048
Total Miles	1,123,046
Average Number of Passengers Per Hour	17.93

Source: Springfield City Utilities

Urban Sprawl and Health

Unplanned urban growth can significantly impact human health. The Centers for Disease Control and Prevention encourages the involvement of public health officials more often in community planning and transportation issues. CDC urges state and local officials to involve public health staffs in planning and zoning decisions, promote mixed land-use, help plan locations of new schools, push for increased development of bike paths and sidewalks, and support car pool and mass transit initiatives.

As sprawl occurs, people become more reliant upon automobiles, thus increasing the potential for car crash injuries/fatalities, pedestrian injuries/fatalities, and air pollution. As mentioned earlier in this chapter (see the section entitled “Bicycle Lanes, Greenways, and Trails in Greene County”), sprawl is also associated with decreased physical activity and increased rates of obesity. Water contamination becomes another concern because pollutants that run-off from concrete/asphalt surfaces seep into groundwater. Additionally, sociological effects of sprawl can occur, such as endangerment of mental health (i.e., proclivity for road rage) and loss of social capital. Social capital refers to the sense of community that develops from attitudes of trust among citizens, and from better communication among families and neighbors. When people spend more time in vehicles, the opportunity for social interaction decreases, leading to a breakdown in the sense of community.

Smart growth is a popular solution being used to curb problems resulting from urban sprawl. Smart growth refers to mixed land-uses and high density land-use. Communities that use these techniques often incorporate both single-family homes and apartment housing in close proximity to each other, rather than segregating them. Housing options in smart growth communities range from the more luxurious to more affordable choices. In addition to housing, smart growth communities also combine stores, businesses, and schools so people can go to work or school, shop, dine, etc., within a relatively small area. Smart growth provides a good balance of greenspaces and park land, mass transit, and bicycle/walking paths. Cities subscribing to smart growth principles may use regulatory methods to encourage more walking/biking and less motor vehicle traffic in downtown areas. For example, Portland, Oregon, has decreased its downtown speed limits, making the area safer for pedestrians. Also, Portland reduced the number of downtown parking spaces in an effort to reduce vehicle traffic. Another common smart growth technique used to reduce vehicle traffic is construction of narrower streets and wider sidewalks.

In addition to better air quality and physical health, there are many other benefits related to walking rather than driving. When people walk within their communities, they are more likely to engage in social interaction with others. Such social interaction improves mental health and increases social capital, thus creating a sense of community. Furthermore, walking or biking reduces infrastructure costs since fewer vehicles on the road equates to less wear-and-tear on streets.

Many people may be reluctant to move into cities and downtown areas because costs can, in many cases, be prohibitive. Increased living costs can be alleviated a great deal, however, by factoring in cost savings gained by owning fewer automobiles. Many families residing in sub-

urbs own several vehicles because of the distance to work or school. By moving into cities where walking or alternative forms of transportation become viable options, reliance upon automobiles decreases.

Brownfields

A brownfield is an area of industrial or commercial property that has been abandoned and is typically environmentally contaminated. These conditions make brownfields unfavorable sites for redevelopment. Several sites in the Jordan Creek Corridor have been identified as potential brownfields. The range of the Jordan Creek Corridor, which encompasses 250 acres in the downtown area, lies between Kansas Expressway, Fremont Avenue, College and St. Louis Streets, and Chestnut Expressway.

The Jordan Creek Corridor was formerly an area of heavy industrial and manufacturing uses. Specific commercial uses in the area included agricultural mills, lumberyards, coal yards, machine shops, quarries, trash dumps, auto repair shops, and gas stations. The prevailing result of these uses was the development of brownfields. In addition to the traditional hazards associated with brownfields, other problems exist as well. One problem is the depreciation of property. According to Greene County records, property values in the corridor have declined in recent decades. In some cases, property values declined by as much as 88 percent. Another concern is the risk of chemical contamination faced by neighborhoods in close proximity to the Jordan Creek Corridor. Abandoned structures found in the corridor pose further problems. Abandoned sites invite homeless people and criminals, as well as endanger children by exposing them to chemicals and unstable structures.

A major objective of the Vision 20/20 comprehensive plan is redevelopment of the Jordan Creek Corridor into a civic park. The planned civic park in the historic downtown area will serve as the cultural and community center for the City of Springfield. The task of redeveloping this area will not be easy, however, due to various barriers such as negative perceptions about the area, fear of contamination, increased access to undeveloped land on the outskirts of the community, and limited investment capital. With the use of grant funding, city officials are currently working to redevelop brownfield sites in the Jordan Creek Corridor. In addition to removing the health hazards that resulted from past industrial and manufacturing activities, the goal of these redevelopment efforts is to encourage commercial, retail, and residential development in the downtown area. Additional goals are curbing pollution, preserving historic sites in the area, and creating parks and green spaces.

Figure 1-1 shows the brownfields area in downtown Springfield. The shaded area represents the range of the Jordan Creek Corridor where brownfields sites are located. Figure 1-2 identifies sites of contamination sources found within the brownfields area. The abbreviation *UST* designates petroleum storage tanks, and *LUST* designates leaking underground storage tanks.

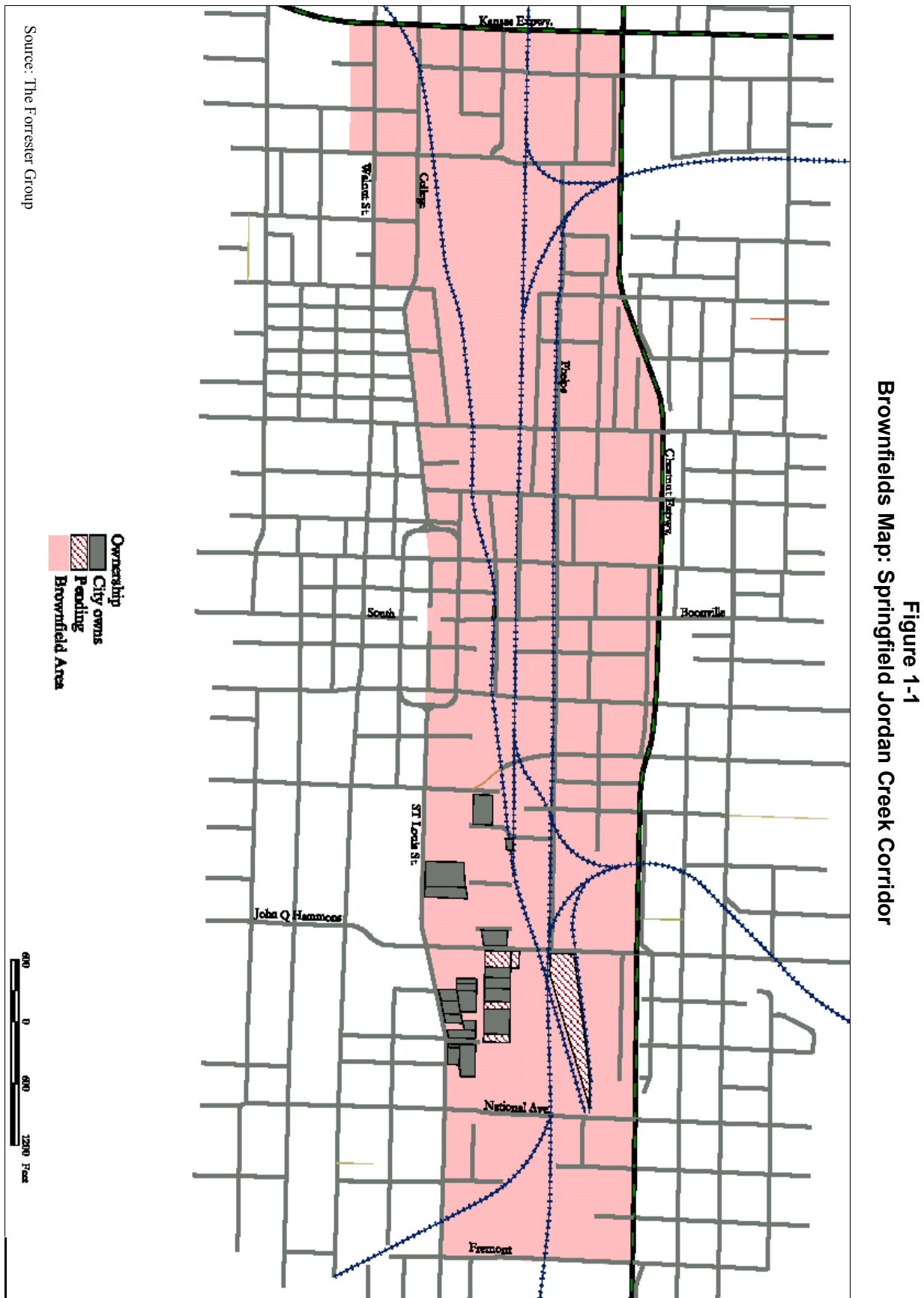
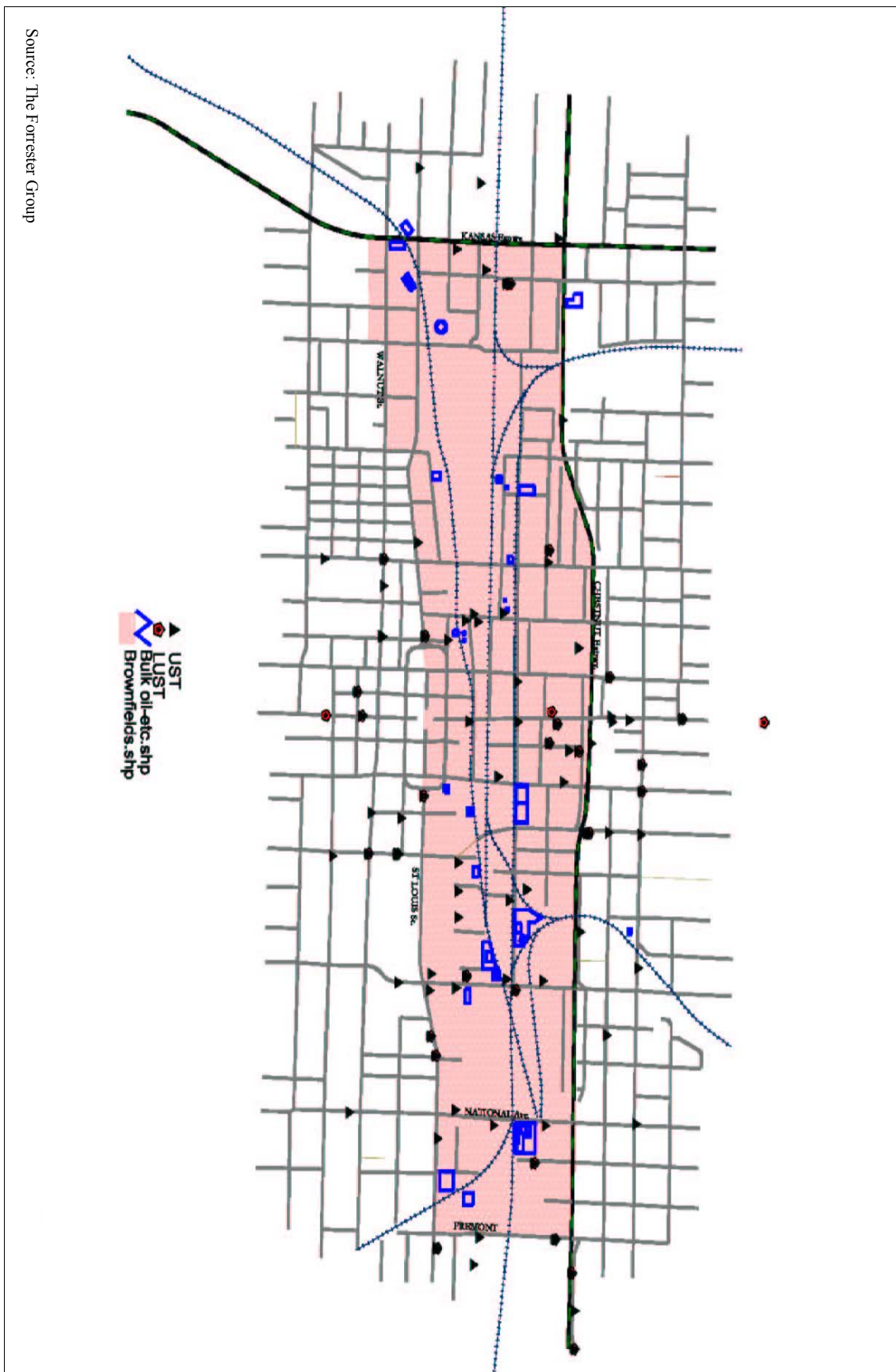


Figure 1-2
Brownfields Contaminant Map: Springfield Jordan Creek Corridor



FOR MORE INFORMATION ON THE POPULATION, GROWTH, AND URBAN SPRAWL ISSUES DISCUSSED IN THIS CHAPTER, CONSULT THE FOLLOWING SOURCES USED IN THIS ASSESSMENT...

- *Benefits of Trees in Urban Areas*
Website at <<http://www.coloradotrees.org/benefits.htm>>
- *Bicycle Advocacy Report Card—Bikes Belong Coalition, Ltd.*
Website at <<http://bikesbelong.org/site/page>>
- *Centers for Disease Control and Prevention*
Website at <<http://www.cdc.gov>>
- *City of Springfield Department of Public Works, 2001 City Tree Inventory*
Website at <<http://www.ci.springfield.mo.us/egov/publicworks>>
- *City Utilities of Springfield*
Website at <<http://www.cityutil.com>>
- *City Utilities of Springfield, 2002 Long Range Plan*
- *The Forrester Group, Inc. Website at <<http://www.forrestergroup.com>>*
- *Greg McPherson, PhD, USDA Forest Service, Dept. of Environmental Horticulture, University of California, Davis, CA*
Website at <<http://wcufre.ucdavis.edu>>
- *Jordan Creek Corridor Brownfields Assessment Demonstration Pilot — a collaborative grant effort between the City of Springfield and the Forrester Group, March 1999. Project Director, Mary Lilly Smith, Economic Development Coordinator*
- *Missouri Office of Social and Economic Data Analysis*
Website at <<http://www.oseda.missouri.edu/>>
- *The National Arbor Day Foundation: Web page for Tree City, USA*
Website at <<http://www.arborday.org/programs/treeCityUSA.html>>
- *Ozark Greenways, Inc*
Website at <<http://www.ozarkgreenways.org>>
- *U.S. Census of Agriculture*
Website at <<http://www.nass.usda.gov/census/>>
- *U.S. Forest Service*
Website at <<http://www.fs.fed.us>>
- *United States Bureau of the Census*
Website at <<http://www.census.gov>>

SPRINGFIELD AND GREENE COUNTY

WATER QUALITY

We never know the worth of water till the well is dry.

~Thomas Fuller, Gnomologia, 1732

*The activist is not the man who says the river is dirty. The activist is
the man who cleans up the river.*

~Ross Perot

How strange that Nature does not knock, and yet does not intrude!

~ Emily Dickinson

The poetry of the earth is never dead.

~ John Keats

Did You Know?

- **The City of Springfield had approximately 971 miles of sanitary sewer pipe in 2000, with about 20 miles being constructed each year.**
- **Of all the private wells tested between 1990 and 2000, 37 percent were categorized as unsafe.**
- **Since routine testing began, City Utilities has reported no presence of *E. coli* or fecal coliform in the City's treated water.**
- **Several tests were taken over the course of a year (2000-2001) on 24 Greene County Springs. The combined mean *E. coli* levels for all tests exceeded the recommended standard for whole body contact.**
- **Three major watersheds drain Greene County: the James, Sac, and Pomme de Terre River Watersheds.**
- **According to the Missouri Department of Conservation, 41 fish kills have been investigated in the James River Watershed since 1980, and all but five occurred in Greene County.**

Introduction

Our water resources are highly valued because they serve a variety of purposes. Because of the importance of our water resources, water quality continues to be a major concern for residents in the Ozarks. Although there is always room for improvement, most of our water resources are currently of high quality. This chapter presents an assessment of several topics related to water quality in Springfield and Greene County. The topics discussed in this chapter are as follows: wastewater treatment, private wells, public/community wells, municipal drinking water, waterborne illnesses, spring water quality, surface water quality, and well drawdown. Also, three case studies are presented in this chapter. The case studies discuss fecal coliform bacteria in Pearson Creek, the Fellows-McDaniel Lakes Watershed Protection Project, and the Fulbright Spring Protection Project. The concluding section of this chapter identifies several ways individuals can conserve water, both indoors and outdoors.

Two organizations instrumental in the development of this chapter were the Watershed Committee of the Ozarks and the James River Basin Partnership. The Watershed Committee of the Ozarks is “a not-for-profit organization of local citizens of diverse backgrounds with the intent of preserving and improving water quality in the Ozarks area through education and information gathered through articles and research, then making that information available to the general public.” The James River Basin Partnership, whose mission is “working to protect and improve the water quality in our springs, streams, rivers, and lakes,” has the following goals: “implement water quality evaluation protocol; implement programs to positively impact water quality; increase citizen participation in water quality issues; and, develop sustainable funding sources.” The Watershed Committee of the Ozarks can be contacted at (417) 866-1127, and the James River Basin Partnership can be contacted at (417) 836-8877. Additional contact information for these organizations is provided on the concluding page of this chapter.

Wastewater Treatment

In the year 2000, the City of Springfield maintained 971.66 miles of sanitary sewer pipe with about twenty miles of new pipe being constructed annually. The City has two wastewater treatment facilities, the Southwest Wastewater Treatment Plant and the Northwest Wastewater Treatment Plant. The Southwest Wastewater Treatment plant has a daily treatment capacity of 42.5 million gallons. The treatment capacity for the Northwest Wastewater Treatment Plant is 6.4 million gallons per day. As for the other localities in Greene County, Battlefield, Strafford, and Willard pump their wastewater to Springfield, while Republic, Fair Grove, Walnut Grove, and Ash Grove have independent systems.

Due to the high usage of our water resources for tourism and recreation, maintaining good water quality in Wilson Creek, the James River, the Little Sac River, Table Rock Lake, and Stockton Lake is of major importance. The City of Springfield is dedicated to improving and preserving these water resources. A major issue concerning area streams and lakes is phosphorous loading. Although phosphorous is necessary for a healthy aquatic environ-

ment, excessive amounts can cause various negative impacts. Phosphorous is a nutrient that contributes to the growth of algae, increased amounts of which could cause a body of water to lose its aesthetic appeal. Additionally, excessive amounts of algae resulting from nutrient loading in a body of water (eutrophication) can, upon die-off, reduce oxygen in water. The result of this process is increased stress on fish and other aquatic organisms.

The Springfield Public Works Department estimates that, prior to January 2001, 27% of the phosphorous entering Table Rock Lake was from the Southwest Wastewater Treatment Plant's treated wastewater discharge. The remaining 73% came from agricultural and residential runoff (both of which contain pesticides and fertilizers), as well as other small treatment plants. The City of Springfield has taken several steps over recent years to reduce the levels of phosphorous loading taking place in the James River Basin. In 1993, \$30 million went toward improvements at the Southwest Wastewater Treatment Plant, reducing its phosphorous loading by 40%. Two years later, Springfield City Council enacted an ordinance calling for reductions in the use of household laundry detergents containing high levels of phosphorous. In 1997, an additional \$1.9 million was expended for more phosphorous removal equipment. It is important to note that the Southwest Wastewater Treatment Plant is now meeting the 0.5 mg/l phosphorus limit even though this requirement doesn't go into effect for another two years. Springfield's Southwest Wastewater Treatment Plant now contributes less than five percent of the phosphorous entering Table Rock Lake.

Private Well Water Quality

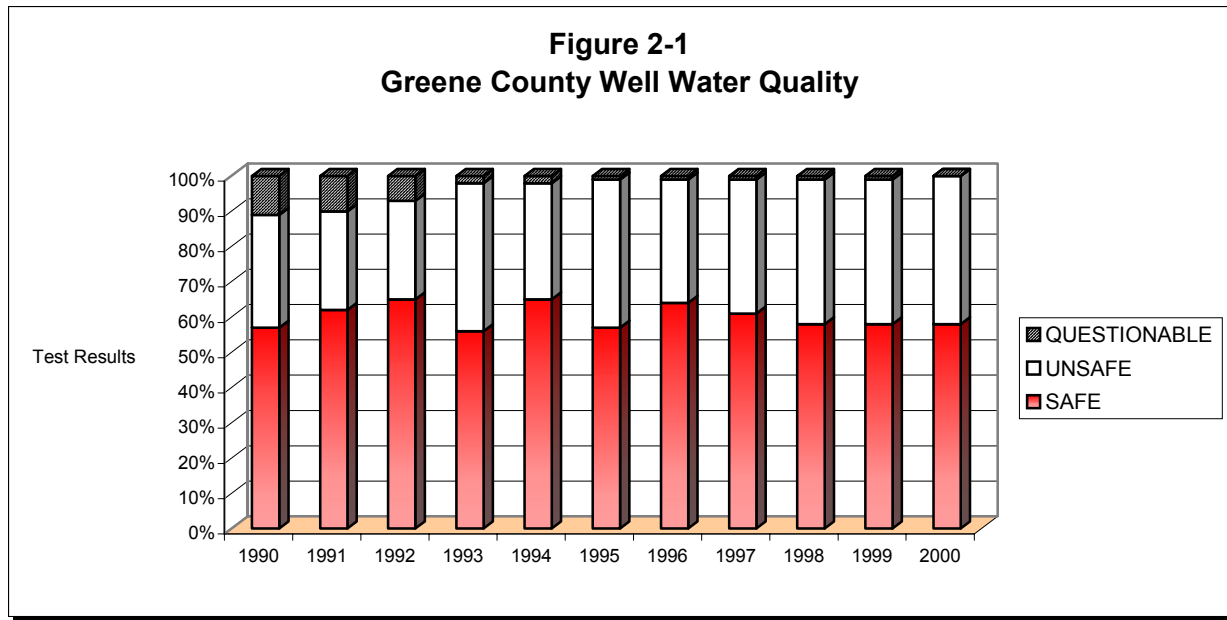
Routine bacteriological analysis of wells in Greene County typically determines whether water is contaminated with coliform bacteria (found in the intestinal tracts of mammals), indicating that it may be unsafe to drink. In the past, water analyses yielded one of three results: safe (no coliform), unsafe (coliform present), and questionable (abundance of extraneous bacteria making determination of coliform detection infeasible). In 1993, a new water analysis test replaced the old membrane filter system. The new test, named Colilert, removed the questionable category from test results, leaving only safe and unsafe.

The following figures represent the number of wells tested per year from 1990 to 2000:

<i>1990</i>	<i>1,436</i>	<i>1996</i>	<i>1,000</i>
<i>1991</i>	<i>1,923</i>	<i>1997</i>	<i>1,021</i>
<i>1992</i>	<i>2,259</i>	<i>1998</i>	<i>1,039</i>
<i>1993</i>	<i>2,210</i>	<i>1999</i>	<i>964</i>
<i>1994</i>	<i>845</i>	<i>2000</i>	<i>1,286</i>
<i>1995</i>	<i>1,286</i>		

Figure 2-1 shows well water quality data for these wells from 1990 to 2000. The figures in the questionable category subsequent to 1993 (after implementation of Colilert) are test

results taken by the state under the old membrane filter testing system. It should be mentioned that the following data were not obtained, obviously, by random sample. Well water is tested upon request by the owner, sometimes because of odor, turbidity, or illness. The data show that safe levels of water quality in tested wells have remained fairly stable over the period.



Source: Springfield-Greene County Health Department

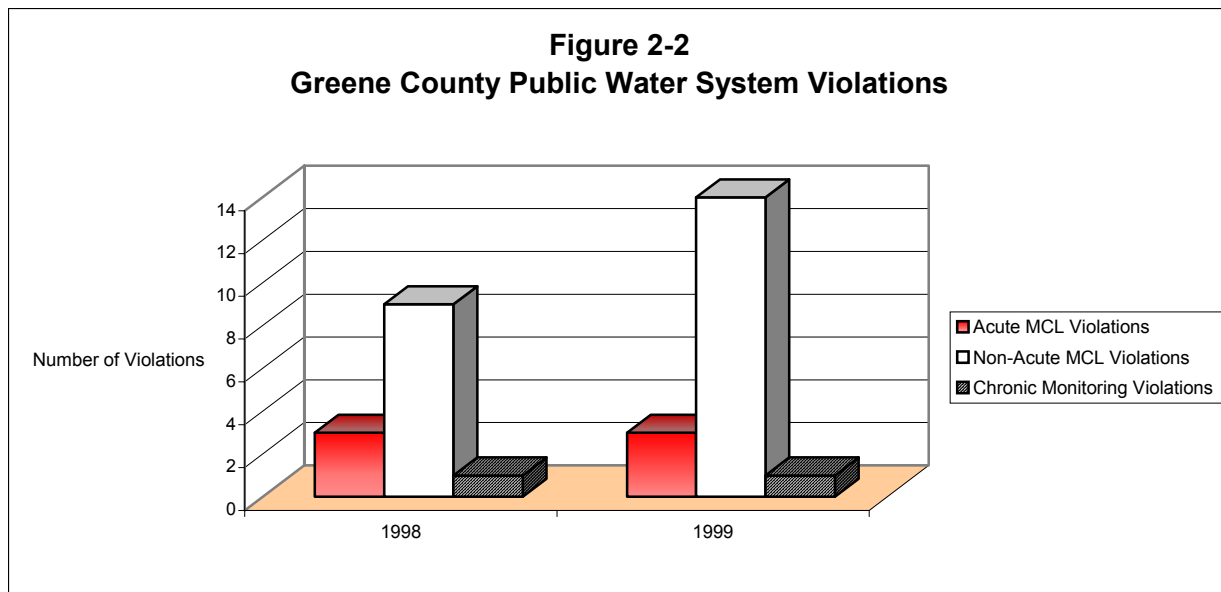
Public/Community Well Water Quality

The Missouri Department of Natural Resources submits to the Environmental Protection Agency an annual report detailing water quality for public water systems, including information on violators. The information in this section concerns public water systems in Greene County for 1998 and 1999. Public water systems provide water to at least 15 service connections or serve an average of 25 people for at least 60 days per year. There are three types of public water systems: (1) *community systems* are found in residential areas where the people consume the water daily (e.g., subdivisions, mobile home parks, and towns/cities); (2) *non-transient, non-community systems* include schools and factories where people regularly drink the water, but in a non-residential setting; and (3) *transient, non-community systems* have users that are primarily pass-through customers, such as travelers (e.g., resorts, campgrounds, and restaurants).

There were three types of violations in Greene County for 1998 and 1999: acute maximum contaminant level (MCL) violations, non-acute MCL violations, and chronic monitoring violations. The maximum contaminant level is the highest amount of a contaminant that the Department of Natural Resources allows in drinking water in order to ensure its safety. An acute MCL violation is typically one where the system found fecal coliform or *E. Coli* in its water. A non-acute MCL violation is characterized as one where the system found total

coliform in the water at frequencies or levels that violate the established standard for microbiological contaminants in drinking water. A chronic monitoring violation is the failure to meet the annual water monitoring frequencies set by DNR.

Figure 2-2 below shows the number of these three types of violations in 1998 and 1999. As evidenced in the chart, acute MCL violations and chronic monitoring violations remained stable while the number of non-acute MCL violations increased.



Source: Missouri Department of Natural Resources

Municipal Drinking Water Quality

Five watersheds serve the water supply for the City of Springfield: The Stockton Lake Watershed, the James River Watershed, the Fellows Lake Watershed, the McDaniel Lake Watershed, and the Fulbright Spring Recharge area. City Utilities maintains water treatment facilities at the Blackman Plant (southeast of Springfield) and at the Fulbright Plant (north of Springfield). The Blackman Water Treatment Plant receives its water from the James River, Fellows Lake, and one deep well. Water is supplied to the Fulbright Treatment Plant from Fulbright Spring, McDaniel Lake, and a deep well. Both McDaniel Lake and Fellows Lake can be supplied with water from Stockton Lake. Three other deep wells are located in the distribution system and can be used as water sources. Following is information on four commonly monitored analytes (analyzable components of water) that pertain to the quality of Springfield's municipal drinking water supply.

Total Trihalomethanes (TTHM)

TTHM have been a growing concern related to drinking water issues. TTHM are by-products that result when chlorine (a disinfecting agent) combines with certain organic chemicals naturally occurring in the water. The municipal drinking water supply for Springfield has shown a decline with respect to TTHM in recent years. The maximum contaminant level (the highest level of contaminant allowable in drinking water) for TTHM is 100 parts per billion. For the year 2000, the average TTHM level for Springfield was 35.0 parts per billion (ppb), indicating that levels in Springfield were well below the maximum allowable level.

E.coli and Fecal Coliform

The presence of these bacteria indicate that the water may be contaminated with human or animal waste. Incidents of death from exposure to certain pathogenic strains have occurred primarily in the elderly and young children. Common symptoms resulting from exposure are diarrhea, cramps, and nausea. Since routine testing began, City Utilities has not found these bacteria in the City's treated water.

Total Coliform

Coliform are bacteria naturally present in the environment that are used to indicate the possible presence of potentially harmful bacteria. City Utilities routinely monitors total coliform levels for Springfield's municipal drinking water and has rarely witnessed incidences of total coliform in its treated water. These instances have been negative for *E.coli* or fecal coliform bacteria.

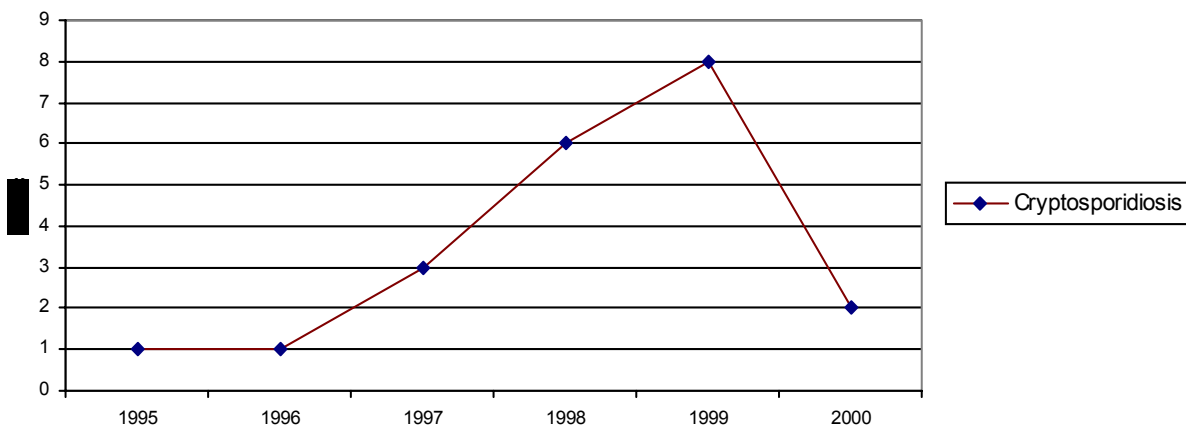
Waterborne Illnesses

This section discusses two waterborne illnesses, cryptosporidiosis and giardiasis. Figure 2-3 shows the number of cryptosporidiosis cases in Greene County since 1995. Figure 2-4 presents the number of giardiasis cases in Greene County since 1992.

Cryptosporidiosis

Cryptosporidium is a microscopic parasite found in the feces of humans and animals. Illness (cryptosporidiosis) can occur from fecal-oral contact or exposure to food or water contaminated with the parasite. Symptoms resulting from exposure to *Cryptosporidium* typically last one to two weeks in a person with a healthy immune system. Those persons with weakened immune systems may experience life-threatening complications from exposure. City Utilities has reported no presence of *Cryptosporidium* in treated waters since routine testing began in 1993. However, cases of cryptosporidiosis still occurred. These illnesses likely resulted from swimming in contaminated waters, eating contaminated food, or through contact with an infected animal or person.

Figure 2-3
Greene County Cryptosporidiosis Cases

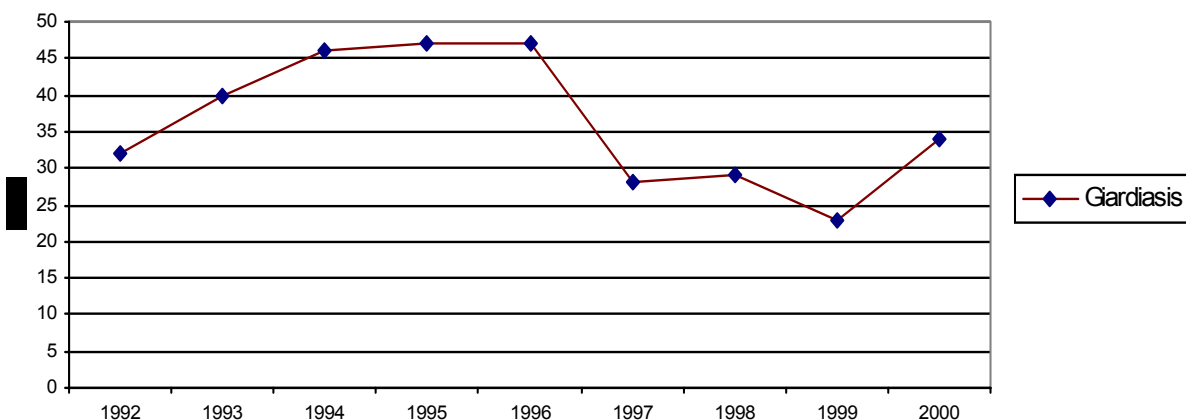


Source: Springfield-Greene County Health Department

Giardiasis

Giardia is a protozoan that causes the intestinal illness giardiasis. *Giardia* is transmitted through fecal-oral contact, or exposure to contaminated food or water. The usual amount of time before symptoms become apparent, however, is seven to ten days. Infection occurs most often between July and October in children under five years of age and in adults from ages 25-39. City Utilities reports that since 1993, there has been no occurrence of *Giardia* in the treated waters of Springfield. Despite this fact, cases of giardiasis still occurred, as seen in the graph below. Here again, illness was likely due to swimming in contaminated waters, eating contaminated food, or through contact with an infected animal or person.

Figure 2-4
Greene County Giardiasis Cases



Source: Springfield-Greene County Health Department

Spring Water Quality

The Watershed Committee of the Ozarks seasonally samples the water quality of several springs in Greene County. Table 2-1 provides the mean water temperature in degrees Fahrenheit, mean level of dissolved oxygen (DO) in milligrams per liter, mean level of nitrates, and *E. coli* in colony forming units (cfu) per 100 milliliters. The data include measurements taken in March 2000, June 2000, September 2000, December 2000, and March 2001. The following springs were used for sampling:

<i>Southern Hills</i>	<i>Kelley</i>	<i>Rader</i>	<i>Boegner</i>
<i>Nature Center</i>	<i>Sanders</i>	<i>Ritter East</i>	<i>Ritter West</i>
<i>Stoddard</i>	<i>Mobley</i>	<i>Camp Cora</i>	<i>Sequiota</i>
<i>Jones</i>	<i>Clear Creek</i>	<i>Bigbee</i>	<i>McKerrel</i>
<i>Doling</i>	<i>Silver</i>	<i>Howell</i>	<i>Hoffmeister</i>
<i>Ritter Park</i>	<i>Hall</i>	<i>Amphitheater</i>	<i>Sims</i>

The average temperature for springs in the Ozarks typically ranges between 56°F and 60°F. As indicated in the table, the average temperature of the sampled springs was within this range. Dissolved oxygen, the second measure, is important because adequate levels are needed to support aquatic life. Fish, for example, become stressed when dissolved oxygen levels drop below 4.0 mg/l. As evidenced below, averages of dissolved oxygen for the springs in Greene County were above the recommended level.

The sources of nitrates can be pesticides, fertilizers, septic tanks, and animal feed lots. Nitrates are introduced to both groundwater and surface water from runoff or seepage into the soil. Nitrates are harmful to infants as they can cause a rare blood condition called “blue-baby syndrome” (termed this because of the bluish color of an exposed baby’s skin). The table below indicates that the mean level of NO₃ was 5.1 mg/l, which is well below the standard of 10 mg/l. Lastly, levels of *E. coli*, a type of fecal coliform, should not exceed 200 cfu /100 ml. When this level is exceeded, whole body contact is not recommended. Average *E. coli* levels for the sample springs listed above exceeded this mark, as indicated in the table.

Table 2-1
Greene County Spring Water Quality

Temp °F	DO (mg/l)	NO3 (mg/l)	E.coli (cfu/100ml)
58.9	9.1	5.1	294

Source: Watershed Committee of the Ozarks

Surface Water Quality

Greene County is located in the Springfield Plateau region of the Ozarks Plateau physiographic province. Physiographic areas of the United States are grouped into provinces and regions based on factors such as geology, geomorphology (landforms), and hydrology. The region known as the Springfield Plateau is characterized by karst terrain (terrain with an abundance of landforms such as springs, streams, sinkholes and caves). Over 2,500 sinkholes and more than 100 springs and caves have been identified in Greene County alone. In general, assessments of surface water conditions in the Ozarks have yielded excellent results compared to other areas of the country. Various pollution sources, however, have the potential to impair water quality conditions, especially within areas of growing population such as Greene County.

One water pollution concern is mercury contamination. In 2001, state officials released a Missouri Fish Consumption Advisory for largemouth bass that exceed 12 inches in length. The statewide advisory warned that certain at-risk persons should not consume these fish due to mercury contamination. Mercury is a toxic substance, particularly dangerous to persons younger than twelve years, pregnant women (or women who may become pregnant), and women nursing infants. Mercury is especially harmful to the nervous system, kidneys, and liver. Because mercury accumulates in fish muscle, trimming the fat or grilling will not reduce the potential for exposure. Reports from the Missouri Department of Conservation indicate that largemouth bass are safe to eat by persons not in the at-risk category.

Although mercury is emitted from natural sources, most emissions are from man-made sources. The Missouri Department of Conservation provides the following list of mercury sources: coal and oil burning, commercial/industrial boilers, lead smelting, cement and lime kilns, crematories, dental amalgam preparation and disposal, electrical product manufacturing and disposal (switches, fluorescent lights, some headlights, and batteries), evaporation of mercury from landfills, garbage incinerators, hazardous waste incinerators, industrial wastewater discharge, laboratories, medical waste incinerators, residential boilers, wastewater treatment plants, and wood burning.

Section 303(d) of the federal Water Pollution Control Act requires each state to identify all waters that fail to meet water quality standards. The Missouri Department of Natural Resources is the agency charged with identifying and compiling the list of waters under Section 303(d). The bodies of water in Greene County designated under Section 303(d) are the James River, Pearson Creek, the Little Sac River, Wilson Creek, and McDaniel Lake.

Water quality issues within Greene County watersheds are another important issue. The term watershed refers to a region that drains into a stream, river, or other body of water. Three major watersheds drain Greene County: The Sac, James, and Pomme de Terre River Watersheds. These river systems are important to local and regional areas as they provide sources of drinking water, recreation, and economic benefits.

Sac River Watershed

Comprising 2,000 square miles in Greene County, the Sac River Watershed is the County's largest watershed. Located in north and northwestern Greene County, approximately 61% of the county is located in this watershed. The Little Sac Watershed has been intensively monitored over the past fifteen years due in large part to its contribution to the drinking water supply for the City of Springfield. The Little Sac Watershed is influenced by both urban and agricultural land uses. *E. coli* levels above the water quality standard for whole body contact (swimming) have been identified in various tributaries. Generally, increased incidences of other waterborne diseases such as cryptosporidiosis and salmonellosis have been associated with higher levels of bacteria in surface waters. The Little Sac proper does not often exceed whole body contact standards.

Nutrients such as phosphorus and nitrogen have been observed to follow the same trends as bacteria. Excessive levels of phosphorus and nitrogen have the potential to create algal blooms, which may negatively impact aquatic life, and could deplete oxygen levels. Although only a few human health impacts (for example, danger from exposure to toxins found in some blue-green algae) are associated with such conditions, other impacts such as poor fishing or aesthetic decline may occur.

Urban streams in this watershed indicate gradual signs of water quality degradation. Pea Ridge Creek, for instance, has shown decreasing levels of macroinvertebrate diversity populations. Macroinvertebrates are a good indicator of stream health since populations of these organisms decline with reduced habitat and poor water quality. The presence of urban pollutants such as heavy metals (e.g., lead, mercury, and nickel) or volatile organic compounds (e.g., hydrocarbons, oxygenated hydrocarbons, and organic compounds containing nitrogen or sulfur) are other indicators of urban water quality degradation. Rural streams such as the South Dry Sac have shown excellent diversity in macroinvertebrate populations.

James River Watershed

The James River Watershed, which comprises 131,000 acres, is located in eastern Greene County. Approximately 31% of the county is located in this watershed. The James River Watershed, which is a drinking water source for the City of Springfield, exhibits water quality conditions similar to those in the Sac River Watershed. A majority of this watershed is located in agricultural areas, which can contribute bacteria and nutrients. A portion of this watershed is also influenced by urban runoff. Pearson and Galloway Creeks have been identified as having degraded populations of macroinvertebrates. Also, *E. coli* levels exceeding whole body contact standards have been observed at public access areas, namely Crighton Access.

According to the Missouri Department of Conservation, there have been 41 fish kills in the James River Basin since 1980, all but five in Greene County. In Jordan Creek, 13 fish kills were recorded, while Wilson Creek and the James River each had five. Sewage spills are the most commonly cited source of these problems. In 1991, a Level I Advisory was issued for all fish species due to chlordane (an insecticide harmful to the nervous system) found in the James River from the mouth of Wilson Creek to Piney Creek. A Level I Advisory indicates that contamination levels are elevated, but lower than the level of concern. Also in 1991, a Level III

Advisory was issued for paddlefish in the James River and Table Rock Lake. The advisory was extended to carp and channel catfish in Wilson Creek. Level III Advisories indicate contamination at or above the level of concern. No advisories related to chlordane are currently in effect for this watershed.

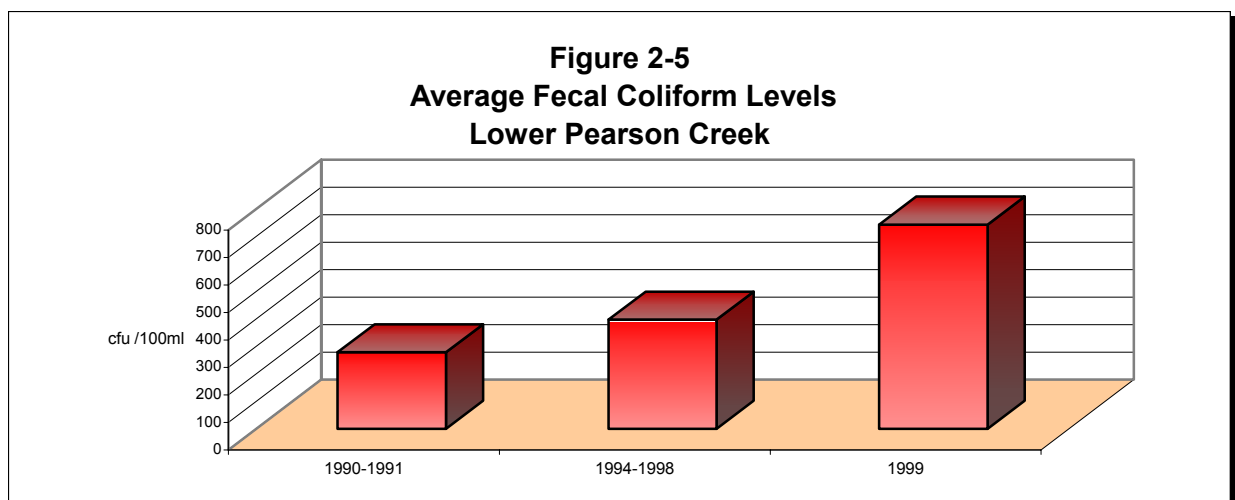
Pomme de Terre Watershed

A portion of the Pomme de Terre River Watershed is located in northeastern Greene County. The land-use in this watershed is primarily agricultural, comprising approximately 36,000 acres. Only eight percent of Greene County is in the Pomme de Terre Watershed. Fair Grove is the largest Greene County municipality located in this watershed. Problems such as fish kills and contaminant spills have occurred in the Pomme de Terre Watershed. These problems typically took place, however, near municipalities outside of Greene County.

Pearson Creek

Pearson Creek joins the James River just upstream of the Blackman Water Treatment Plant. Figure 2-5 shows the average levels of fecal coliform in lower Pearson Creek (near the confluence with the James River) from 1990-1991, 1994-1998, and in 1999. The graph indicates that average levels of fecal coliform have increased in the lower portion of Pearson Creek since the 1990-1991 measurements. Similar to *E. coli*, when fecal coliform levels exceed 200 cfu/100ml, whole body contact is not recommended. For all three time periods presented in the graph, fecal coliform averages exceeded the recommended level. Some potential factors causing the heightened levels of fecal coliform in lower Pearson Creek are increased cattle watering, failing septic systems, and urban runoff due to increased development.

A City Utilities' study compared macroinvertebrates in Pearson Creek for the years 1964-1965, 1992, and 1999. Macroinvertebrates are a good indicator of stream health since populations of these organisms decline with increased adverse impacts to a stream. The findings indicated that macroinvertebrates have declined, probably due to negative impacts caused by increasing urbanization.



Source: Watershed Committee of the Ozarks

Well Drawdown

Groundwater level declines have been occurring in Springfield for decades, according to the Department of Natural Resources. Further declines are expected, particularly if groundwater use continues to increase. Groundwater levels have been monitored by the Missouri Department of Natural Resources' observation well network since 1956. The observation wells are equipped with electronic recorders that measure water levels every 30 minutes, record the obtained values, and send the data back by radio transmission to a monitoring office every four hours.

One problem associated with declining groundwater levels is well drawdown, as numerous complaints have been received concerning this issue. Drawdown occurs when water is pumped from a well or wells, causing groundwater levels to drop. The greater the pumping rate of the well, the greater the drawdown expected. When drawdown occurs, groundwater levels are impacted, often a long distance from the well. One high capacity well that pumped 2,000 gallons per minute, for example, was recorded to create a water level decrease of 57 feet two miles from the well. At a distance of six miles from the well, a 31 feet decline was recorded. As a result, adjacent wells are often affected by the lowered groundwater levels. In addition to high-yield wells, the combination of hundreds of small-capacity domestic wells can produce similar effects.

Both domestic wells and high-yield industry/municipal wells often draw water from the same aquifer. The latter type typically drill wells much deeper than domestic wells. As a result, when groundwater levels decline, domestic wells are generally the first to be impacted. In some cases, declining water levels have been severe enough to lead to domestic wells pumping mud.

The primary remedy being considered for residents affected by nearby high-yield wells in Greene County (near Springfield) is to provide them with a water district. Other states, particularly Western states, have also struggled with water quantity issues. Many of these states have developed water rights legislation to help mediate the problem. Worries exist elsewhere in Missouri over the possibility of excessive water use by golf courses and farms. One measure to ameliorate this behavior (used in the Missouri Bootheel) is to require that farmers test moisture levels of the soil before irrigating.

The State of Missouri currently observes the *Reasonable Use Doctrine* with regard to groundwater use. The *Reasonable Use Doctrine* holds that a person can use as much groundwater as needed, provided that the usage does not affect one's neighbors. This doctrine, however, was implemented with no provisions for enforcement. The Springfield-Greene County Health Department and the Watershed Committee of the Ozarks are currently studying areas of Greene County that might possibly be affected by well drawdown.

Case Study: Fecal Coliform Bacteria In Pearson Creek

From June to September of 1999, a student research project for the Watershed Committee of the Ozarks was conducted on Pearson Creek to identify sources of fecal coliform bacteria found in this tributary to the James River. The study, conducted over a period of twelve weeks, consisted of a weekly collection of water samples at six sites along Pearson Creek. Although all six sites had fecal coliform levels that failed to meet safety standards for full body contact, two sites had unusually high fecal coliform levels. The study concluded that cattle operations just upstream from the contaminated sites were the likely source of the high fecal coliform levels in Pearson Creek for that period.

Case Study: Fellows-McDaniel Lakes Watershed Protection Project

In 1992, the Watershed Committee of the Ozarks undertook the Fellows-McDaniel Lake 319 Project. Approval for project implementation was granted by the Missouri Department of Natural Resources under Section 319 of the Clean Water Act. The objective of the project, to improve water quality protection efforts in the watershed, was accomplished through Best Management Practices (BMP), water quality monitoring, and education/outreach. More specifically, these techniques were used to address problems associated with agricultural runoff and individual wastewater systems within the watershed. The project was important to the City of Springfield since McDaniel Lake and Fellows Lake together supply approximately 64 percent of the City's water.

The concern over agricultural runoff in the watershed was primarily due to nutrient loading, a common problem associated with runoff. Nutrient loading is also a problem associated with various types of runoff (i.e., pesticides) from residential lawns. Excessive nutrient loading has caused high levels of algae growth in Fellows and McDaniel Lakes. When algae die from either a lack of sunlight or nutrients, a foul taste and odor can be produced. As part of the project, controls were implemented to curb the runoff of agricultural waste into the watershed. Examples are solar watering systems and animal waste management systems. Solar watering systems allow cattle to be watered a distance from a stream or shallow well. Because cattle spend more time away from the stream, vital stream bank vegetation is protected. Furthermore, cattle are not directly depositing waste into streams.

Another control method is animal waste management systems, whereby animal waste is directed into a catch basin, not a nearby stream. By doing this, captured waste in the basin can later be utilized as fertilizer. The Watershed Committee reports improved water quality in one tributary where these controls were used on nearby farms linked to increased nutrient loading. The Watershed Committee suggests that these controls are likely not the sole source of phosphorous reduction, since several other factors can be influential. Lastly, the Watershed Committee reports that efforts to educate communities (usually by demonstrations) about these practices have been an important factor in gaining public acceptance of methods to reduce agricultural runoff.

Another water quality concern in the Fellows-McDaniel Lakes Watershed is individual wastewater systems. These systems are a concern because they will likely be the primary method for wastewater treatment in areas where no plan exists to extend sanitary services. Also, the effects of independent wastewater systems can be significant because of the thin, rocky soil and karst topography in the watershed, which allows quick-entry of untreated wastewater into groundwater systems.

Case Study: Fulbright Spring Protection Project

In 1995, the Watershed Committee of the Ozarks began implementation of the Fulbright Spring Protection Project. Here again, approval for project implementation was granted by the Missouri Department of Natural Resources under Section 319 of the Clean Water Act. The objective of the project was to address the effects of stormwater runoff and urban development on both the water quality and quantity of Fulbright Spring. Fulbright Spring (Springfield's oldest water supply) is a valuable resource for the City as it supplies an annual average of 17% of the drinking water. Additionally, the operating costs for Fulbright Spring are low since the treatment plant is next to the spring. Pumping costs (at the time of the project) for the Fulbright source were about \$2 per million gallons of water. Pumping costs for all other surface water sources in Springfield were approximately \$230 per million gallons. Furthermore, because the water quality from Fulbright Spring is currently good, treatment costs are low. These factors help to keep water rates within the City fairly low.

Similar to the Fellows-McDaniel Lakes Protection Project, protection efforts for Fulbright Spring were to be achieved through water quality monitoring, BMP, and education/outreach. Various monitoring efforts were used, including stormwater sampling/analyses and macroinvertebrate diversity analyses. Several BMP techniques were implemented. One example is a stormwater facility that controlled both water quantity and quality. Runoff is filtered by grass channels before entering a primary detention forebay. Sediment is deposited in the forebay by settling and the use of a gravel filter, through which runoff drains into a main detention basin. The use of BMP helps demonstrate to developers the economic and environmental benefits associated with using better watershed practices.

With regard to education and outreach, several programs were offered to educate the community on the importance of protecting water resources. Programs addressed various groups, from children to professionals. One program, designed to teach students the principles and importance of protecting water supplies, engaged Carver Middle School students in various field studies such as macroinvertebrate identification, water chemistry, fish identification, and nature interpretation. Another education program was a watershed workshop held for the local media to discuss the importance of reporting water quality issues and to build good media relations.

What Can You Do To Conserve Water?

The amount of water individuals use per day can be astonishing. The EPA, for instance, estimates the average personal water use per day to be 15-30 gallons for bath/shower, one gallon

for brushing teeth, three gallons for cooking/drinking, four to seven gallons for the toilet (per flush), 30 gallons for laundry, 15-60 gallons for washing dishes, and 180 gallons for watering lawns. There are several strategies individuals can use to conserve water. Following are water conservation tips advised by the EPA.

In the bathroom:

- Do not use toilets as waste baskets.
- Do not let the water run while shaving or when brushing teeth.
- Take short showers instead of baths, and turn off the water flow while soaping or shampooing.
- If you must use a tub, close the drain before turning on the water and fill the tub only half full. Bathe small children together.
- Do not pour water down the drain when there may be other uses for it such as watering plants.

In the kitchen or laundry room:

- Store drinking water in the refrigerator instead of letting the faucet run until the water is cool.
- Rather than using running water, wash fruits and vegetables in a basin.
- Thaw frozen foods in the refrigerator rather than using water.
- Use a dishpan for washing and rinsing dishes.
- Scrape, rather than rinse, dishes before loading into the dishwasher.
- Add food waste to your compost pile instead of using the garbage disposal.
- Operate the dishwasher only when completely full.
- Use the appropriate water level or load size selection on the washing machine.

Outside:

- Sweep driveways, sidewalks, and steps rather than hosing off.
- Wash the car with water from a bucket, or consider using a commercial car wash that recycles water.
- When using a hose, control the flow with an automatic shut-off nozzle.
- Avoid purchasing recreational water toys which require a constant stream of water.
- If you have a swimming pool, consider a new water-saving pool filter.
- Lower the level of pool water to reduce amount of water splashed out.
- Use a pool cover to reduce evaporation when pool is not being used.

Equipment:

- Repair all leaks. A leaky toilet can waste 200 gallons per day. To detect leaks in the toilet, add food coloring to the tank water. If the colored water appears in the bowl, the toilet is leaking.
- Install ultra-low flow toilets, or place a plastic container filled with water or gravel in

the tank of your conventional toilet. Be sure it does not interfere with operation of the toilet's flush mechanisms.

- Install low-flow aerators and showerheads.
- Consider purchasing a high efficiency washing machine, which can save over 50 percent in water and energy use.

Lawn and Garden Watering:

- Detect and repair leaks in irrigation systems.
- Use properly treated wastewater for irrigation where available.
- Water the lawn or garden during the coolest part of the day (early morning is best), and do not water on windy days.
- Water trees and shrubs, which have deeper root systems, longer and less frequently than shallow-rooted plants that require smaller amounts of water more often. Check with the local extension service for advice on the amount and frequency of watering needed in your area.
- Direct sprinklers toward lawns and gardens, not streets or sidewalks.
- Landscape using Xeriscape Principles, which yields “an attractive, sustainable landscape that conserves water and is based on sound horticultural practices.” The use of Xeriscape Principles can be observed in the City of Springfield’s Phelps Grove Park at Linwood and National.
- Use soaker hoses and trickle irrigation systems.

Planting/Maintaining:

- Have your soil tested for nutrient content and add organic matter if needed. Good soil absorbs and retains water better.
- Use native plants/grasses in your landscape--they require less care and water than ornamental varieties.
- Use mulch around shrubs and garden plants to reduce evaporation from the soil surface and to cut down on weed growth.
- Raise your lawn mower cutting height since longer grass blades help shade each other, cut down on evaporation, and inhibit weed growth.
- Minimize or eliminate fertilizing, which requires additional watering and promotes new growth that requires watering.
- Avoid using ornamental water features unless they recycle the water, and do not use them during a drought.

FOR MORE INFORMATION ON THE WATER QUALITY ISSUES DISCUSSED IN THIS CHAPTER, CONSULT THE FOLLOWING SOURCES USED IN THIS ASSESSMENT...

- *Fellows-McDaniel Lakes Watershed Protection Project*
Written by the Watershed Committee of the Ozarks, Sept. 30, 1998
- *Fulbright Spring Protection Project*
Written by the Watershed Committee of the Ozarks, September 2000
- *Missouri Rivers and Their Watersheds.*
Written by the Missouri Department of Conservation
Website at <www.conservation.state.mo.us/fish/watershed>
- *Springfield Greene-County Health Department*
Website at <www.ci.springfield.mo.us/health>
- *Understanding Water Quality in the Pearson Creek: The Effects of Land Use on Fecal Coliform Bacteria. A Research Project for the Watershed Committee of the Ozarks.*
Written by Jennifer J. Jones, 1999.
- *Water Resources of Greene County (January 1997).*
Written by the Watershed Committee of the Ozarks
Website at <www.watershedcommittee.org>
- *Watershed Committee of the Ozarks, Inc.*
320 North Main
Springfield, MO 65806
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information@watershedcommittee.org
- *James River Basin Partnership*
Holland Building, Suite 204
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Telephone: 417-836-8877
Fax: 417-836-8879
dianasheridan@smsu.edu
- *Watershed Review 2000. Norman W. Youngsteadt, Senior Analyst-Watershed Coordinator. Central Laboratory, City Utilities of Springfield.*
- *Water Treatment and Supply FY 2000 Annual Report.*
Written by City Utilities of Springfield Website at <www.cityutil.com>

SPRINGFIELD AND GREENE COUNTY

AIR QUALITY

One touch of nature makes the whole world kin.

~ William Shakespeare

You go into a community and they will vote 80 percent to 20 percent in favor of a tougher Clean Air Act, but if you ask them to devote 20 minutes a year to having their car emissions inspected, they will vote 80 to 20 against it. We are a long way in this country from taking individual responsibility for the environmental problem.

*~William D. Ruckelshaus, former EPA administrator,
New York Times, 30 November 1988*

In an underdeveloped country, don't drink the water; in a developed country, don't breathe the air.

~Changing Times magazine

In all things of nature there is something of the marvelous.

~Aristotle

Did You Know?

- **Radon is the second leading cause of lung cancer behind tobacco.**
- **In addition to various respiratory problems, the National Cancer Institute has linked secondhand smoke to Sudden Infant Death Syndrome, as well as behavioral and cognitive problems in children.**
- **The Springfield-Greene County Health Department maintains five sites for monitoring ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide, and particulate matter.**
- **Maintenance of good indoor air quality is important as people spend an average of 90 percent of their time indoors.**

Introduction

Good air quality is not only important, but necessary to the overall wellness of Greene County. When air quality is threatened, all organisms suffer. Humans and animals alike may experience poor health when exposed to harmful air pollutants. Likewise, plants and structures can be damaged by the effects of poor air quality. The Springfield-Greene County Division of Air Quality Control has made it their mission to “manage our air resources so that today’s clean air will be maintained well into the future.” The following sections comprise this chapter on air quality in Greene County: ambient air quality, mobile source air emissions, industrial source air emissions, and indoor air quality. The concluding section looks at several ways individuals can improve the quality of the air.

Ambient Air Quality

According to the Environmental Protection Agency’s Air Quality and Emissions Trends Report, several criteria air pollutants exist that are of concern to human health. The pollutants measured and tracked at monitoring stations nationwide are carbon monoxide (CO), sulfur dioxide (SO₂), lead (Pb), nitrogen dioxide (NO₂), ozone (O₃), and particulate matter, which includes both fine particles (PM_{2.5}) and coarse particles (PM₁₀). The former designation, PM_{2.5}, describes particulate matter with a diameter less than or equal to 2.5 microns. PM₁₀ is a designation for particulate matter less than or equal to 10 microns. Following is a description of the seven major pollutants including their origins and health effects.

Carbon monoxide

- A poisonous gas resulting from the incomplete burning of carbons in fuel. The primary source of CO is motor vehicles. Industry, wildfires, woodstoves/fireplaces, and cigarettes are also common sources of CO. Carbon monoxide is odorless, colorless, and tasteless.
- Because carbon monoxide reduces oxygen going to the organs and tissues of the body, people with cardiovascular disease are most seriously threatened when exposed to low concentrations of the pollutant. Exposure to higher concentrations of CO can have effects on health such as visual impairment, reduced motor skills, decreased learning ability, headache, dizziness, nausea, vomiting, unconsciousness, and death.

Sulfur Dioxide

- Created by burning fuels containing sulfur (e.g., coal and oil) and through industrial processes such as metal smelting.
- Health effects related to sulfur dioxide exposure are respiratory tract irritation, chest pain, and wheezing. Examples of environmental impacts of sulfur dioxide pollution are acid rain and acid deposition in soil and water.

Lead

- Vehicle emissions were once the largest source of lead contamination in the atmosphere. With increased emission regulations on the transportation industry (for example, the removal of lead from gasoline), the major source of ambient air contamination from lead is now the metal processing industry. Lead is a bluish-white, silvery-gray solid typically found in a particulate form. Due to significantly decreased levels of lead in the air, monitoring is not performed routinely and, as a result, is not heavily addressed in this assessment.
- Lead exposure may cause several adverse health conditions such as fatigue, heart disease, hypertension, mental retardation, birth defects, seizures, coma, and death. Lead also negatively impacts plants and wildlife. Additionally, lead can alter the growth rates of certain plants and impair reproduction of aquatic animals.

Nitrogen dioxide

- NO₂ is a gas formed by the oxidation of nitrogen in the air or nitrogen-containing compounds. NO₂ and other nitrogen oxides (NO_x) interact with volatile organic compounds (i.e., organic compounds containing nitrogen or sulfur to form ozone). NO₂ and other NO_x compounds are emitted from motor vehicles and power plants, as well as natural sources such as lightning and biological processes in soil. NO₂ is a reddish-brown, poisonous gas.
- Exposure to nitrogen oxides may cause respiratory illness or irritation, headache, and nausea. Environmental impacts of NO_x are ozone formation, acid rain, and eutrophication (creation of conditions favorable to algae proliferation, which reduces aquatic oxygen and depletes populations of other aquatic organisms).

Ozone

- Ozone is a byproduct of atmospheric reactions among NO_x, volatile organic compounds (VOCs), heat, and sunshine. Both NO_x and VOCs come from motor vehicle and industry emissions, as well as natural sources (e.g., lightning and biological processes in the soil). Ozone forms a protective layer above the Earth, but at ground level it is a pollution problem, contributing to the formation of smog.
- As a health concern, ozone may induce coughing, chest pain, eye irritation, and respiratory irritation and infection.

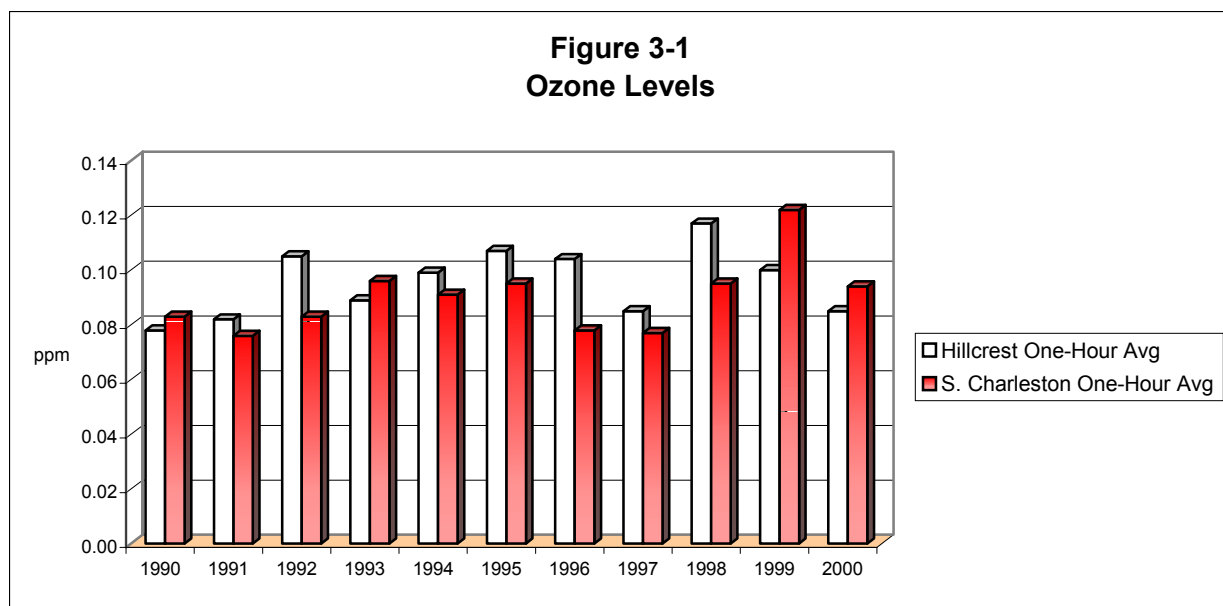
Particulate Matter

- According to the Department of Natural Resources, inhalable particles are chemically and physically diverse. Particulate matter can be in a liquid or solid form and it originates from both mobile (on-road and off-road vehicles) and stationary (industry) sources. Particulate matter can also be a natural source, such as dust.
- Health effects related to inhalable particulate exposure include various respiratory illnesses. Particulate matter tends to aggravate other respiratory conditions such as asthma. Also, particulate matter is harmful to plants because it blocks sunlight absorption when it collects on leaves.

Local Air Quality Monitoring Sites

Under the 1990 Clean Air Act, the EPA was given new enforcement powers, making it easier to penalize violators of the Act. The 1990 law increased penalties for violators (e.g., businesses, industries, individuals, etc.) of the Act, and it enabled the EPA to fine those found exceeding national air quality standards. Also under the 1990 Clean Air Act, the EPA and states worked to clean-up areas with poor air quality. Subsequent to passage of the Clean Air Act, the EPA and state governors worked to determine nonattainment areas (geographic areas that exceed the standard level considered safe for a pollutant). Next, the EPA classified the nonattainment areas based on how severely polluted the areas were. Using the classification system, clean-up requirements were made and realistic deadlines set for reaching clean-up goals. An area that misses a deadline is typically allotted additional clean-up time. As a result, these areas are usually required to meet stricter clean-up standards. In addition to meeting deadlines, nonattainment areas must be able to show they are making reasonable progress in their clean-up efforts before the deadline.

The Springfield-Greene County Health Department maintains air-monitoring sites at five locations: Hillcrest High School, James River South on East Evans Road near the Battlefield Fire Station, 5012 South Charleston, 1555 South Glenstone, and Southwest Missouri State University. Site placement is dictated under the guidance and monitoring objectives of the Environmental Protection Agency. Air quality monitoring stations are strategically placed in areas believed to have higher concentrations of pollutants. The following graphs give information on EPA monitoring guidelines, monitoring periods, monitoring sites, and pollutant measurements.



Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources

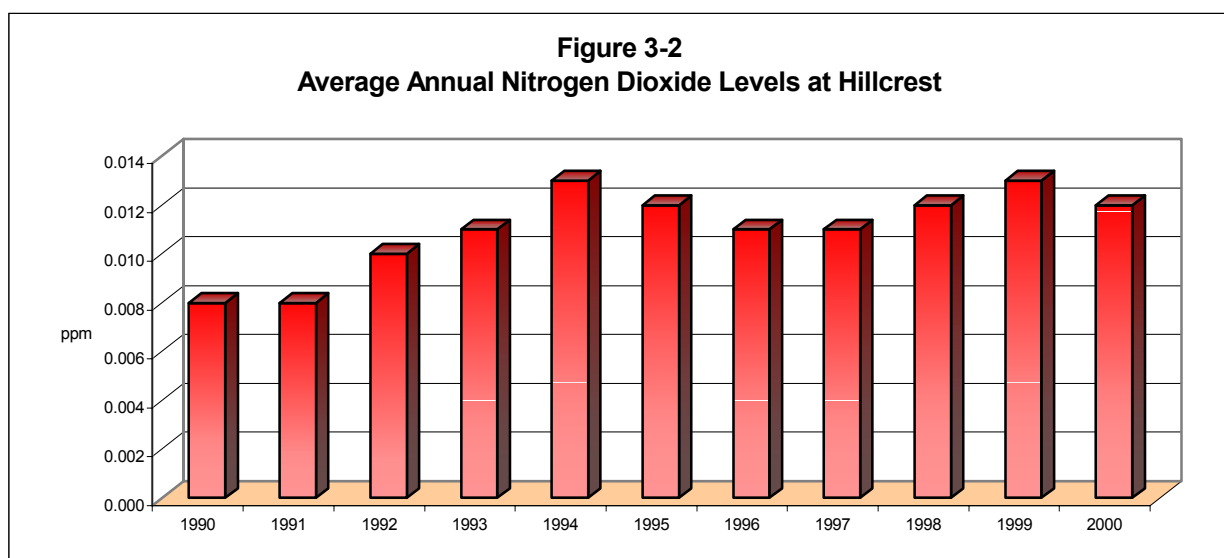
As shown in figure 3-1, ozone is monitored at two sites in Springfield, Hillcrest High School and South Charleston. Ozone levels are based on one-hour averages and are measured in parts per million (ppm). The National Ambient Air Monitoring Standard, set by the EPA, is 0.12 ppm based on one-hour averages. The data reflected in this graph show that Springfield has not exceeded the national standard, and ozone levels remained fairly stable over the period.

Figure 3-2 provides the annual averages for nitrogen dioxide at Hillcrest High School from 1990 to 2000. The average annual National Ambient Air Monitoring Standard for nitrogen dioxide is 0.053 ppm. The data indicate an upward trend in annual averages, although pollutant levels remain well below the standard.

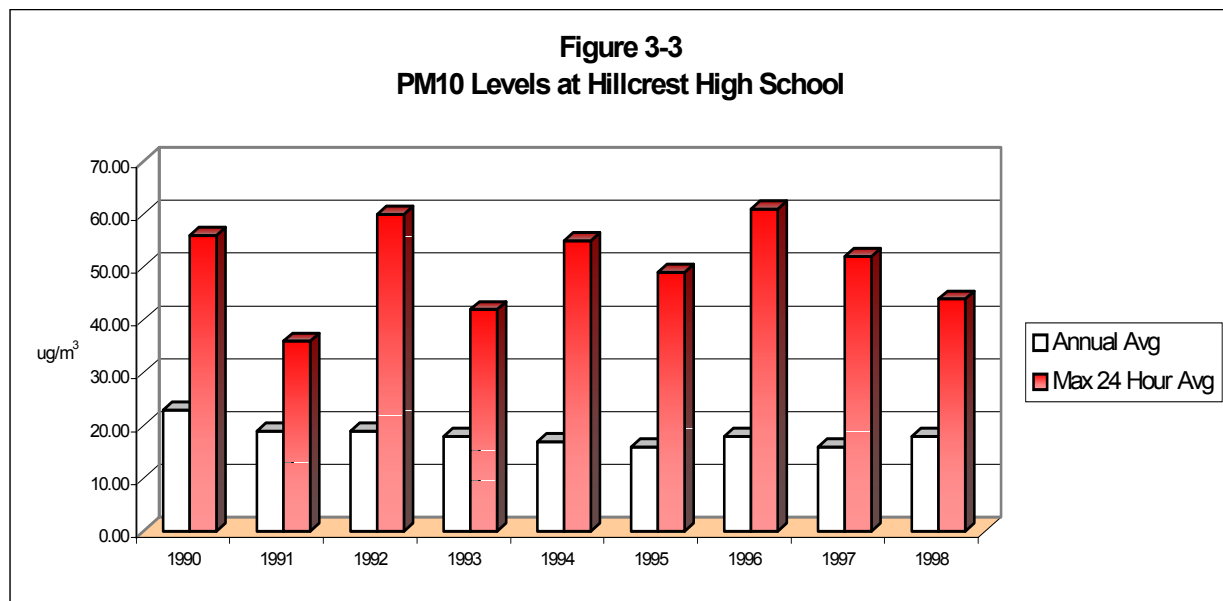
PM₁₀ levels are measured in micrograms per cubic meter (ug/m³). The standards are 150 ug/m³ for the 24-hour average and 50 ug/m³ for the annual average. Annual levels of inhalable particulates at Hillcrest High School (Figure 3-3) were less than 20 ug/m³ and daily levels were at or below 60 ug/m³. As indicated in the graph, both measures were well below their respective national averages from 1990 to 1998.

The graph data in Figure 3-4, taken from the South Charleston site, show that particulate matter levels have not exceeded the standard averages of 150 ug/m³ (24-hour average) and 50 ug/m³ (annual average) for years 1990 to 1998. As expected, the maximum daily levels averaged about 45 ug/m³. The more stable annual averages were steady around 15 ug/m³.

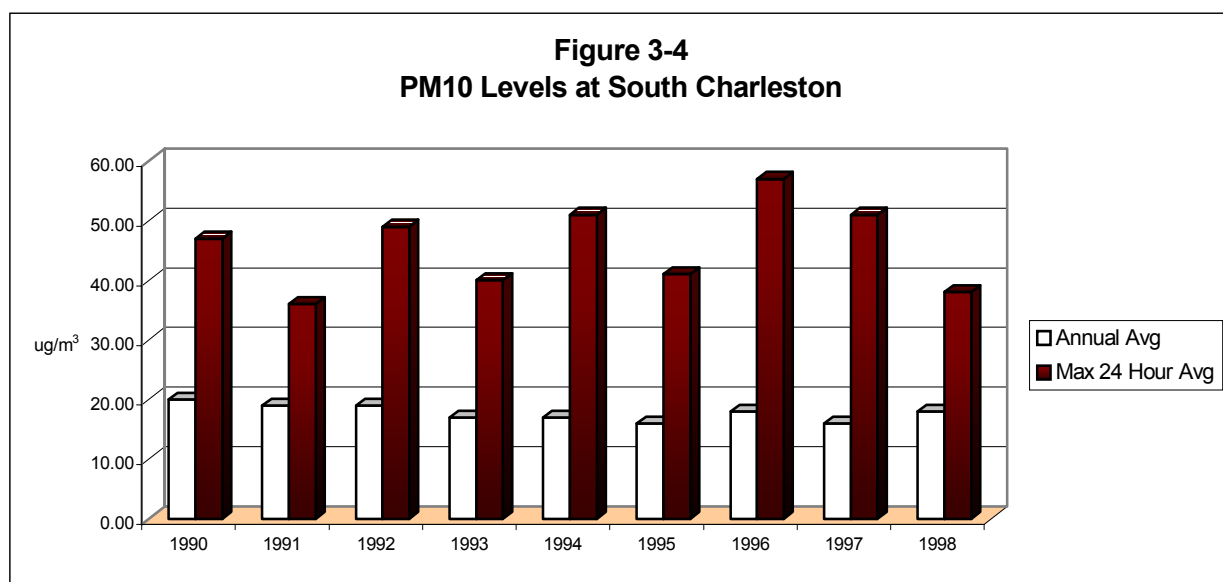
The SMSU site monitors both inhalable particulates PM_{2.5} and PM₁₀. The years 1999 and 2000 are the only available data points for PM_{2.5}. Average daily and annual levels for PM_{2.5} in 1999 and 2000 were below national standards. Figure 3-5 presents data on particulate matter that is ten microns or less. Similar to the levels at Hillcrest and South Charleston, inhalable particulate levels at SMSU have not exceeded national standards.



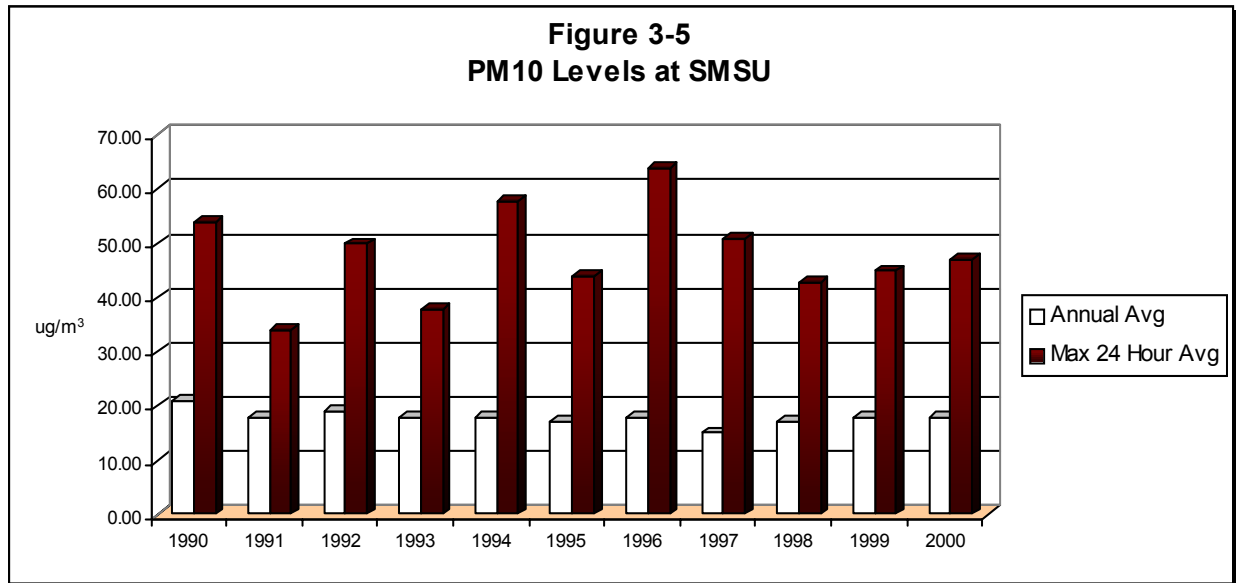
Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources



Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources

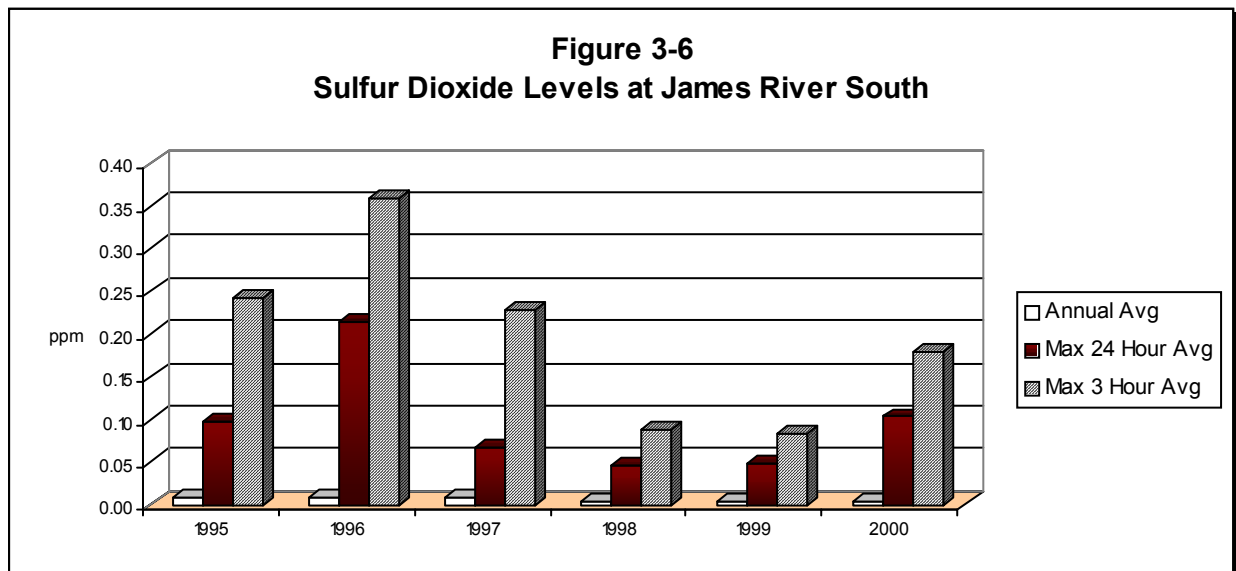


Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources



Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources

Sulfur dioxide levels, documented at the James River site from 1995 to 2000, are averaged on the three bases shown below in Figure 3-6. The standard annual average is 0.03 ppm, the 24-hour standard is 0.14 ppm, and the three-hour standard is 0.50 ppm. Excluding a 1996 exceedance on a 24-hour average, sulfur dioxide levels have been below the national standard from 1995-2000 on all three bases of measurement.

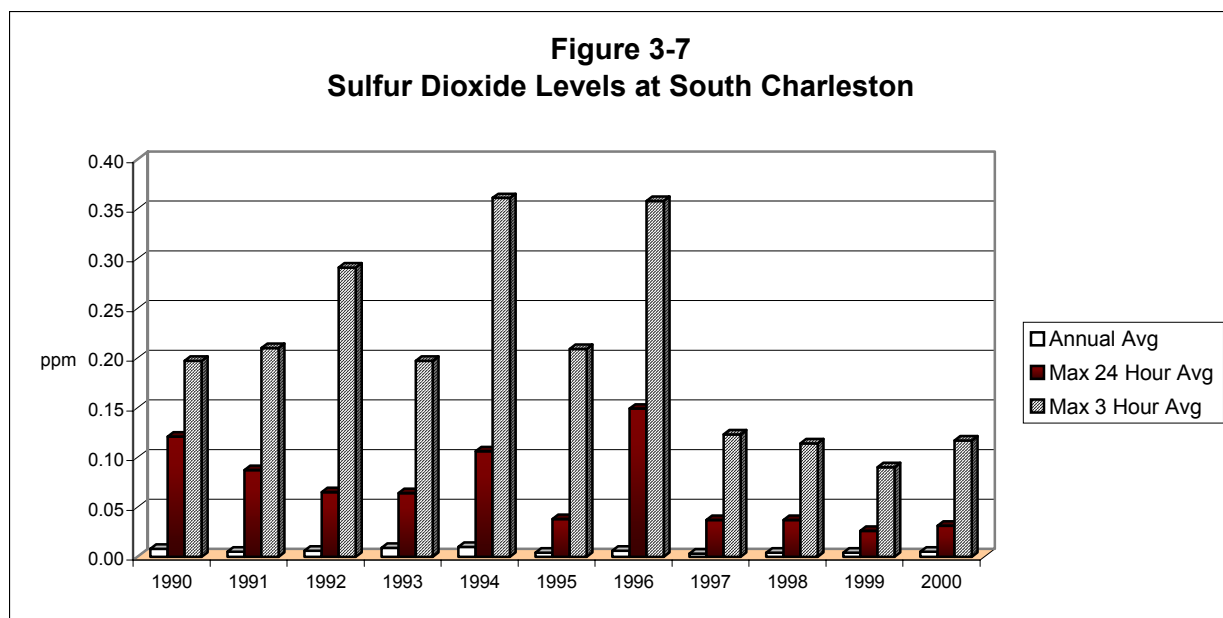


Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources

Similar to the James River South site, South Charleston (Figure 3-7) had one exceedance in its 24-hour sulfur dioxide levels in 1996. With the exception of the 1996 exceedance, sulfur dioxide levels at South Charleston from 1990 to 2000 have fallen below the national standard for all three measures.

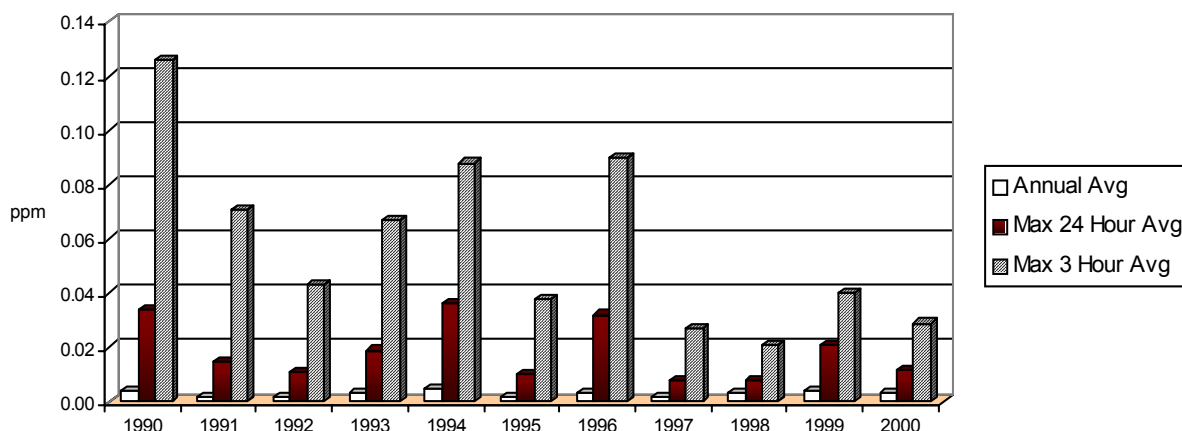
Air quality data on sulfur dioxide at the SMSU monitoring site (Figure 3-8) are based on the time period 1990 to 2000. Based on the three averages by which sulfur dioxide is measured (a standard annual average of 0.03 ppm, a 24-hour standard of 0.14 ppm, and a three-hour standard of 0.50 ppm), sulfur dioxide levels did not exceed their respective national standards.

Carbon monoxide levels are determined by eight-hour averages and one-hour averages. The National Ambient Air Monitoring Standard for the eight-hour average is 9 ppm and the standard for the one-hour average is 35 ppm. As the data in Figure 3-9 indicate, carbon monoxide levels, from 1990 to 2000, have not exceeded the national standards for either average. The maximum one-hour averages fell over the period.



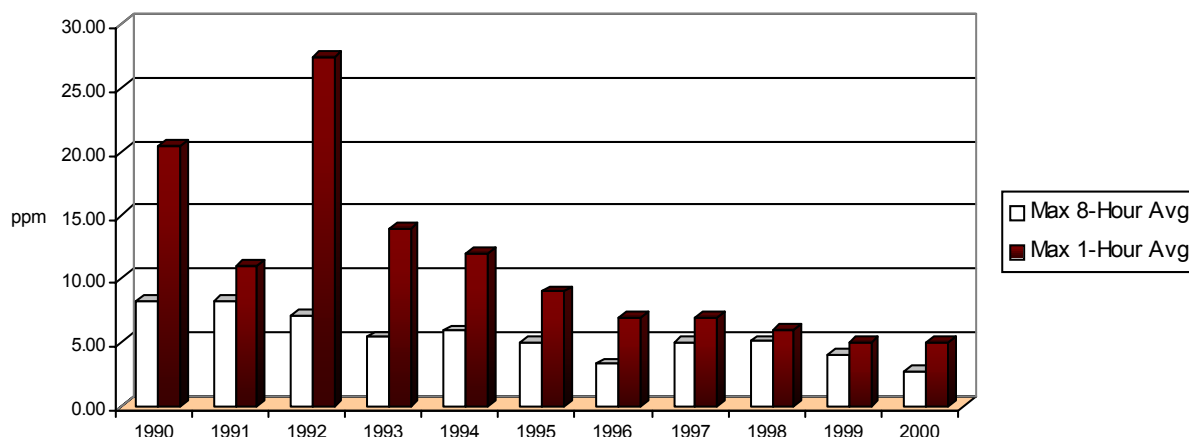
Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources

Figure 3-8
Sulfur Dioxide Levels at SMSU



Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources

Figure 3-9
Carbon Monoxide Levels at SMSU

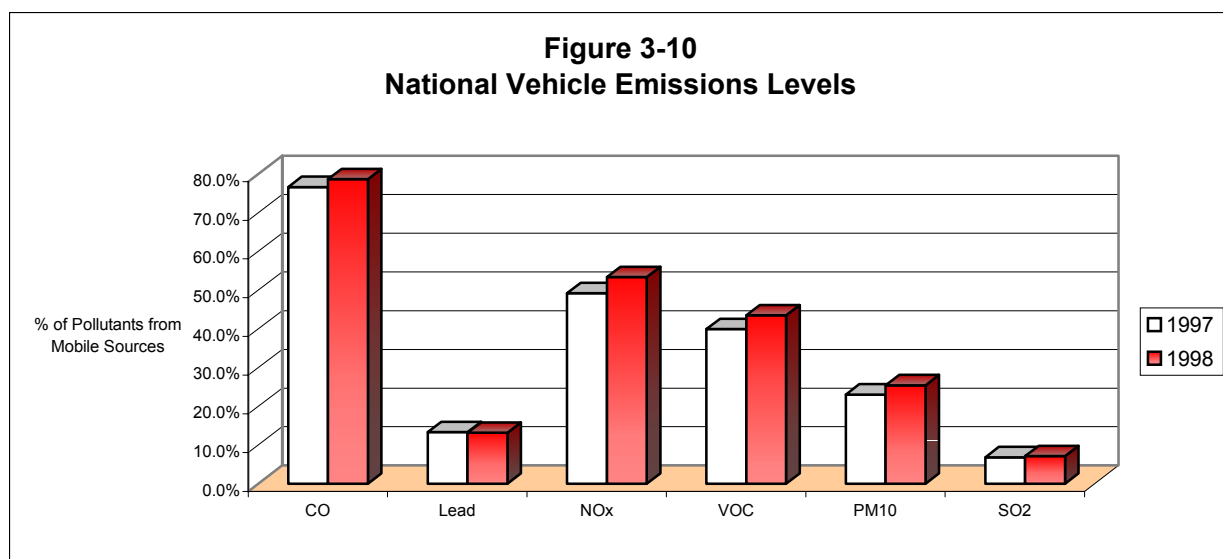


Source: Springfield-Greene County Health Department and Missouri Department of Natural Resources

Mobile Source Air Emissions

Mobile sources of air pollution include both on-road and off-road vehicles. Despite air quality improvements resulting from automotive emission control programs, vehicle emissions have remained a major contributor to air pollution. The EPA indicates that there are currently more than 195 million cars and trucks on the road, averaging more than two per family. Americans drive approximately 6.3 billion miles every day (or 2 trillion miles per year), an increase of 3.9 billion since 1965. Passenger cars and light trucks are the largest source of air pollution nationwide. Although the percentage can be greater in large cities, motor vehicles account for approximately 50% of air pollution, according to EPA reports. A 1997 Congressional Research Service report indicates that in the United States, on-road vehicles account for about 58 percent of carbon monoxide emissions, about 30 percent of nitrogen oxides, about 27 percent of volatile organic compounds, and about 9 percent of particulate matter.

Figure 3-10 shows 1997 and 1998 EPA national trends in vehicle emission levels for the following pollutants: carbon monoxide (CO), lead (Pb), nitrogen oxides (NO_x), volatile organic compounds (VOC), particulate matter (PM₁₀), and sulfur dioxide (SO₂). Levels of NO_x and VOCs are important because they both contribute to the production of ozone. As shown in the graph, vehicle emissions are the largest source of carbon monoxide pollution. Excluding lead, 1998 vehicle emission levels for each pollutant increased from 1997 levels. Table 3-1 shows mobile source air emission estimates (in tons per year) per vehicle type for 1999. The EPA states that the mobile source emission amounts are based partially on data obtained from state and local agencies, however, the information is not official. Further, the EPA cautions that the information may contain errors.



Source: U.S. Environmental Protection Agency

Table 3-1: Greene County Mobile Source Emissions, 1999

	<u>CO</u>	<u>NOX</u>	<u>PM10</u>	<u>SO2</u>	<u>VOC</u>	<u>PM2.5</u>	<u>NH3</u>
Highway Vehicles: Light Duty Gas Vehicles & Motorcycles	26,143	2,795	60	137	3,034	33	175
Highway Vehicles: Light Duty Gas Trucks	15,853	1,655	34	91	1,775	21	76
Highway Vehicles: Heavy-Duty Gas Vehicles	2,933	442	10	16	312	7	4
Highway Vehicles: Diesel	1,979	3,188	151	112	234	132	6
Off-Highway: Non-Road Gasoline	14,415	116	26	12	981	24	1
Off-Highway: Non-Road Diesel	913	1,611	171	353	236	157	2
Off-Highway: Aircraft	740	168	48	12	208	34	4
Off-Highway: Railroads	56	605	16	63	18	15	< 1
Off-Highway: Other	973	260	2	4	< 1	2	n/a
Amounts in Tons per Year							

Source: U.S. Environmental Protection Agency

Commuting Patterns for Regional Counties

Table 3-2 below shows the percentage of workers that commute outside their county of residence. Commuting data were unavailable for the year 2000. Christian, Dallas, and Webster Counties have the greatest number of workers commuting outside their resident counties to work. Many residents from surrounding counties commute to Springfield to work. Greene County has the lowest percentage of residents commuting outside the County to work. Analysis of this information is important as it indicates the stress placed on the County's roads/highways, utilities, and environment by outside residents. Obviously, not all persons living in surrounding counties commute to Greene County (for instance, some Christian county residents may commute to Branson in Taney County). The Census Bureau did not provide information on commuter destinations.

Table 3-2
Percent of Workers Commuting
Outside County of Residence

	1960	1970	1980	1990	2000
Christian	28.1	43.7	55.7	59.2	64.3
Dade	10.7	20.4	27.3	38.9	43.5
Dallas	14.1	34.7	30.9	43.9	53.2
Greene	3.5	3.5	4.0	6.1	7.0
Lawrence	17.5	23.3	30.2	39.9	47.0
Polk	12.0	18.5	28.5	29.9	37.5
Webster	18.9	32.1	34.0	48.6	55.5

Source: U.S. Bureau of the Census

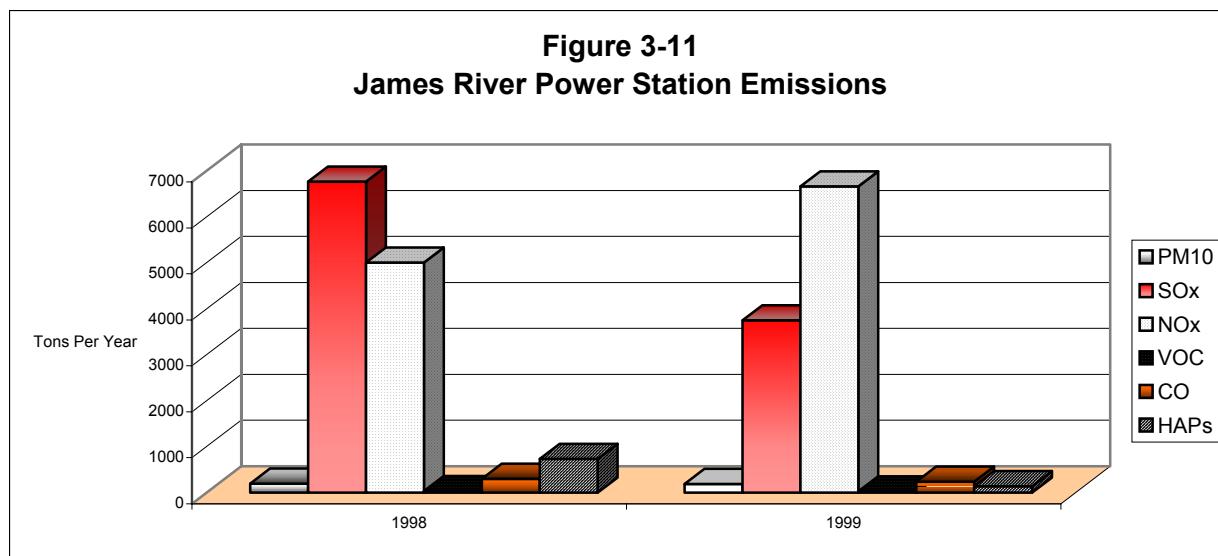
Industrial Source Air Emissions

Table 3-3 and Figures 3-11 and 3-12 show industrial air emission levels for Springfield, the James River Power Station, and the Southwest Power Station, respectively. The figures present emissions data for six pollutants measured in tons per year. The pollutants are inhalable particulates (PM₁₀), sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), carbon monoxide (CO), and other hazardous air pollutants (HAPs). Examples of HAPs are benzene, perchlorethylene, methylene chloride, mercury, and scores of others. These pollutants may cause cancers, respiratory problems, reproductive problems, and nervous disorders. Data for Springfield Industrial Air Emissions (Table 3-3) were taken over a ten-year period from 1989 to 1999. The data in Table 3-3 include emissions from major industrial point source pollution contributors such as manufacturers and power plants. Major industrial polluters (those emitting more than one ton of pollutants per year) are required to report their emissions. The other data sets, presented in Figures 3-11 and 3-12, cover years 1998 and 1999.

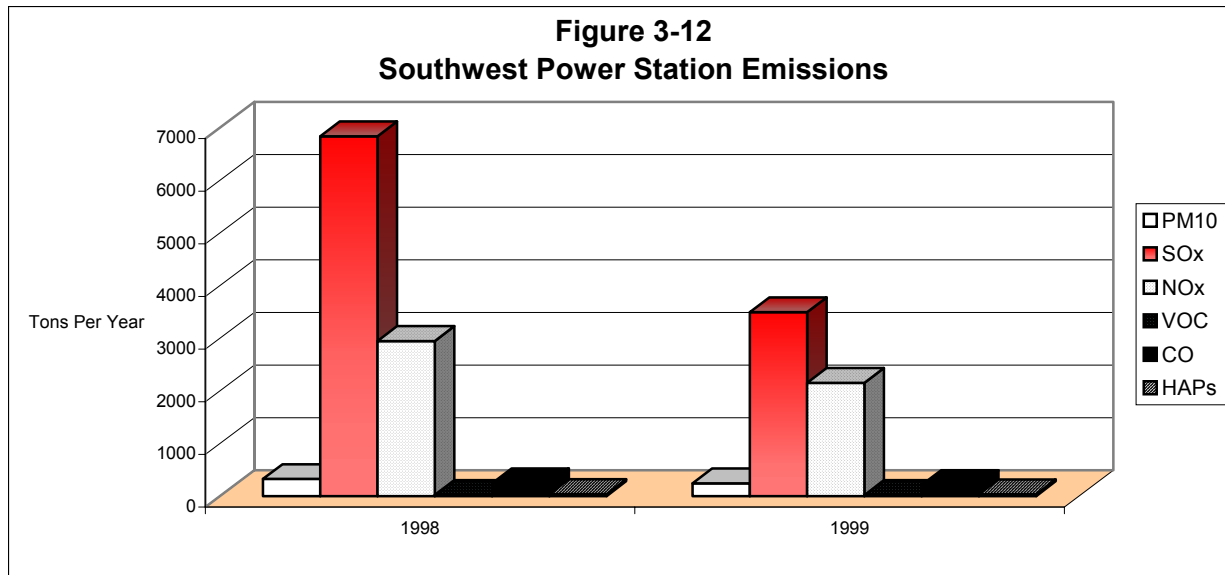
Table 3-3
Springfield Industrial Air Emissions

	PM10	SOx	NOx	VOC	CO	HAPs
1989	452	119	324	2435	266	0
1990	402	226	491	2591	246	0
1991	279	464	453	2915	207	0
1992	485	202	298	2147	51	0
1993	482	227	341	1638	37	0
1994	583	261	386	1034	57	104
1995	353	196	381	979	50	119
1996	264	283	311	1273	57	150
1997	270	151	226	1076	57	148
1998	201	240	284	735	68	114
1999	255	194	274	774	68	105
Amounts in Tons per Year						

Source: Springfield-Greene County Health Department



Source: Springfield-Greene County Health Department



Source: Springfield-Greene County Health Department

Indoor Air Quality

Indoor air quality continues to be a major concern as people spend a great deal of time indoors. The Environmental Protection Agency estimates that people spend 90% of their time indoors. The Springfield/Greene County Health Department provides guidance and reference materials on indoor air quality. This section discusses the following issues related to indoor air quality: radon, secondhand smoke, molds, and asbestos.

Radon

According to the EPA, radon is a leading cause of lung cancer, second to tobacco. Greene County is considered an area that has moderate potential for radon contamination. The EPA recommends that all homes be tested for radon regardless of the potential for that locale, especially since radon testing is easy and inexpensive. A home susceptible to radon contamination should be modified with ventilation systems that displace radon into the air outside the home. Modern construction methods are available to equip new homes with these ventilation systems.

Cigarette Smoke

Smoke from cigarettes is a major indoor air quality concern because of its effects on non-smoking persons in the home, especially children. Children exposed to secondhand smoke are more likely to contract pneumonia and bronchitis. Additionally, children exposed to secondhand smoke are more likely to cough, wheeze, and have increased incidents of ear infections and asthma attacks. The National Cancer Institute links secondhand smoke to Sudden Infant Death Syndrome, as well as behavioral and cognitive problems in children.

Molds

Molds contribute to health problems such as allergic reactions, asthma, and other respiratory illnesses. Since molds are typically found in moist areas, the best way to control them is to fix leaking sources of water, reduce humidity, and thoroughly clean areas where molds exist to prevent them from spreading.

Asbestos

Breathing even small amounts of asbestos for short periods increases a person's risk of lung cancer and mesothelioma (cancer of the chest and abdominal linings). Asbestos was commonly used in homes and buildings for its insulative and flame retardant properties. Asbestos fibers are small and can be easily inhaled. The mere presence of asbestos in a building, however, does not necessarily mean the occupants are exposed to fibers.

What Can You Do To Improve Air Quality?

This chapter has discussed the many negative health consequences associated with a failure to maintain good air quality. The EPA, for instance, reports that poor air quality costs billions of dollars per year in healthcare and lost workdays. In addition to the many government regulations that exist, individuals can voluntarily assist in the improvement of air quality. This section discusses ways individuals can improve air quality with respect to both outdoor and indoor air quality.

Automobiles and Other Engine Emissions

Individuals, if not required, are encouraged to take their vehicles in for auto inspection and maintenance (I/M) programs. I/M programs have proven most effective in reducing smog caused by auto emissions. Through I/M programs, automobile owners are made cognizant of problem emission systems. These programs test to determine whether vehicle emission systems are installed as designed and whether they are effectively controlling pollution emissions. Standards are established in accordance with the vehicle's model year. In most cases, repairs are minor and do not incur significant costs.

Other ways individuals can reduce vehicle emissions are by purchasing fuel efficient vehicles, using public transportation, car pooling, and properly maintaining vehicles. The EPA's website presents information on the emissions ratings of cars—worthy of viewing before making a car purchase. Also, the EPA provides information on various practices being explored throughout the country to assist in improving air quality. The City of Philadelphia, for example, is experimenting with the use of human/electric hybrid vehicles throughout such city departments as the zoo, parks, and airport. The City of Tulsa has instituted a student driver education program in which future drivers are educated about alternative methods of transportation.

The EPA points out that individuals can take actions to help reduce engine emissions and improve air quality. The following recommendations are applicable to many types of

vehicles or equipment, such as automobiles, marine engines, motorcycles, and lawn tractors:

- Limit engine operation at full throttle when possible.
- Eliminate unnecessary idling.
- Avoid spilling gasoline and use a funnel or a spout with an automatic stop device to prevent overfilling the gas tank.
- Buy newer, cleaner burning engines.
- Prepare engines properly for winter storage.
- Close the vent on portable gas tanks when storing.
- Use caution when pumping gasoline into a container at the gas station.
- Carefully measure the proper amounts of gasoline and oil when refueling.
- Follow the manufacturer's recommended maintenance schedule.

Indoor Air Quality

The EPA points out three ways individuals can improve indoor air quality: eliminate the source of air pollution (most effective method), provide better ventilation, and use air cleaners. The first method requires adjusting/repairing gas stoves to reduce emissions, sealing materials/structures that contain asbestos, and not smoking cigarettes/tobacco indoors. Providing better ventilation simply refers to effectively bringing fresh outdoor air inside. Ventilation methods include opening windows or using fans/ducts to replace indoor air with outside air. Adequate ventilation is especially important when engaging in activities such as painting or sanding, or when operating un-vented gas stoves.

The third method the EPA recommends for improving indoor air quality is the use of air cleaners. Household plants, as one example, have been linked to better indoor air quality. Regarding manufactured cleaners, the EPA cautions that several air cleaners are available on the market with some more effective than others. HEPA (high efficiency particulate arrestance) filters are recognized as top quality air filters. HEPA filters remove 99.97% of all particulates down to 0.3 microns (equivalent to 1/75,000 of an inch or 1/300 the diameter of a human hair). HEPA filters are most commonly used in areas where clean air is of utmost importance, such as surgery rooms or isolation wards. As a result, these filters are highly recommended by allergists, medical professionals, and clean air specialists. These filters maintain their efficiency for two to five years (depending on the pre-existing air quality—poorer, dirtier air will shorten filter life span) and require no cleaning or maintenance. Again, the EPA recommends that controlling the source of air quality problems is the best method for improving indoor air quality.

FOR MORE INFORMATION ON THE AIR QUALITY ISSUES DISCUSSED IN THIS CHAPTER, CONSULT THE FOLLOWING SOURCES USED IN THIS ASSESSMENT...

- *The Springfield-Greene County Health Department
Website at <<http://www.ci.springfield.mo.us/health/>>*
- *Environmental Protection Agency: 1997 and 1998 National Air Quality
and Emissions Trends Report*
- *Environmental Protection Agency
Website at <www.epa.gov>*
- *Missouri Department of Natural Resources
Website at <www.dnr.state.mo.us>*

SPRINGFIELD AND GREENE COUNTY

SOLID WASTE MANAGEMENT

We do not inherit the earth from our ancestors, we borrow it from our children.

~Native American Proverb

Nature predominates over the human will in all works of even the fine arts, in all that respects their material and external circumstances. Nature paints the best part of the picture, carves the best of the statue, builds the best part of the house, and speaks the best part of the oration.

~ Ralph Waldo Emerson

So I stand on this narrow strip of wild land, searching not just the world around me but my own heart. These falling leaves, the light dancing on this water, this gray sky, the pungent smell of this damp soil as the life around me returns to the earth that nurtures it.

~ William Cronon

America's last wild places are everyone's good dream — our national commons — the enclaves we set aside for solace and renewal.

~Annick Smith

Did You Know?

- **According to the waste hauling companies in Springfield, approximately 18 to 25 percent of their customers participate in the curbside recycling program.**
- **Since its opening in 1996, the Springfield Household Chemical Collection Center has collected 528,000 pounds of materials, over 85 percent of which were recycled.**
- **In the course of a year, approximately 150,000 cubic yards of yardwaste is processed at the Yardwaste Recycling Center.**
- **Springfield's four recycling centers handle approximately 536,000 pounds of materials per month, or 3,214 tons per year.**
- **Estimates are that the Springfield urban services area generates between 800 and 1200 tons of solid waste per day. Of this amount, 300 to 400 tons per day are received by the Springfield Sanitary Landfill, with residual waste taken to out-of-town landfills.**

Introduction

The Resource Conservation and Recovery Act (RCRA) was enacted by Congress in 1976. The objectives of the RCRA include: the protection of human health and the environment from the potential hazards of waste disposal; energy and natural resource conservation; reduction of the amount of waste generated; and, to ensure that wastes are managed in an environmentally sound manner. The RCRA regulates the management of solid waste (i.e., garbage), hazardous waste, and underground storage tanks holding petroleum products or certain chemicals. In 1999, the EPA reported that the RCRA regulated the production of 230 million tons (equivalent to 4.6 pounds of solid waste per day, per person, for one year) of solid waste in the United States. The United States, in 1999, produced 40 million tons of hazardous waste, according to the EPA.

Solid waste management districts were formed in the State of Missouri in the early 1990s. The establishment of these districts was the result of sweeping solid waste legislation, which also set a state waste reduction goal of 40 percent. In the same legislation, various items were banned from Missouri landfills, including yardwaste and a variety of hazardous materials. A surcharge for each ton of waste collected in Missouri's landfills and transfer stations is collected by the state and a portion is filtered back to the waste districts to support implementation of solid waste management plans.

Counties within districts work together in order to accomplish several functions. These include improvement of environmental conditions related to solid waste management, creation of recycling programs, and working with communities to resolve solid waste issues. Greene County and the City of Springfield are in Missouri's Solid Waste Management District O. Other counties in District O include Dallas, Christian, Polk, and Webster. A major accomplishment of Waste District O is easier citizen access to recycling centers. With a few exceptions, residents within the Waste District have access to recycling services within 20 miles of their homes. All counties within the District have at least one recycling center.

Maintenance of the City of Springfield's Division of Solid Waste Management program is one function of the Public Works Department. The mission of the City of Springfield's Solid Waste Management Division is "to provide an Integrated Solid Waste Management System for Springfield and Greene County that is environmentally sound and economically feasible, which represents a long-term solution to preserve the natural resources of the region for present and future generations." The waste management program in the City of Springfield has been recognized for its excellence through three *Governor's Pollution Prevention Awards* and a *Choose Environmental Excellence Award*.

Springfield's voter-approved Integrated Solid Waste Management System (ISWMS) consists of curbside recycling (provided by private waste haulers), a household chemical collection center, information and education programs, a yardwaste recycling center, City-operated recycling centers, a market development program, and the Springfield Sanitary Landfill. The City of Springfield does not collect trash because solid waste collection is handled by private solid waste hauling companies. There are currently fifteen waste hauling

companies in Springfield. Waste Corps of Missouri and AD/BFI, however, are the two major companies, together controlling about 75 percent of the Springfield market. Individuals are encouraged to contact the Division of Solid Waste Management with any questions about the community's waste management system.

Funding for the ISWMS consists primarily of landfill tipping fees. Additional monies are generated by donations and revenues from the sale of yardwaste compost and mulch. The ISWMS receives no local tax money and no money from the City's general fund. Due to the fluctuation in the amount of solid waste received at the City's Sanitary Landfill, funding remains a challenge to the program. The operating budget for Springfield's ISWMS is approximately \$3 million per year.

This chapter discusses the programs and services offered by the ISWMS in the following sections, respectively: curbside recycling, the household chemical collection center, the information and education program, the yardwaste recycling center, the recycling centers, market development, and the Springfield Sanitary Landfill. The final section in this chapter discusses individual measures that can be used to reduce waste, specifically through the use of the 3 R's—reduce, reuse, and recycle.

Curbside Recycling

In Springfield, all licensed solid waste haulers are required to offer residential curbside recycling. According to the waste hauling companies in Springfield, approximately 18 to 25 percent of their customers participate in the curbside recycling program. The recyclable items collected by waste haulers are newspapers, glass, tin/steel, aluminum, pop bottles, and milk jugs. Curbside collection is a convenient service for residents because it eliminates the need for storage and delivery of recyclables to recycling centers. Because collection occurs either weekly or bi-weekly, large amounts of recyclables will not accumulate in the home or garage. Residents interested in curbside recycling services should contact their waste haulers. Curbside recycling services, however, are not always offered outside the urbanized Springfield area.

Household Chemical Collection Center

Waste chemicals generated from households in Springfield and Greene County are accepted at the Household Chemical Collection Center (HCCC). In addition to protecting groundwater supplies, the services of HCCC prevent harmful household chemicals from entering the wastewater and solid waste streams. Springfield's HCCC was the first year-round, permanent center of its kind in Missouri. Since its opening in 1996, HCCC has collected 528,000 pounds of materials, over 85 percent of which were recycled. Residents are asked to schedule an appointment prior to bringing chemicals to the Center. By calling ahead, the staff can provide callers with information about the most proper and safe methods for transporting materials, or recommend other disposal alternatives, if appropriate. The appointment system ensures the safety of both technicians and residents.

The HCCC does not accept unknown materials (items without labels), pharmaceuticals, explosives/ammunition, radioactive materials, infectious wastes, compressed gas cylinders, laboratory chemicals, and business/commercial wastes. It does accept:

- Automotive products such as antifreeze, batteries, brake fluid, car wax or cleaners, gasoline, oil filters, transmission fluid, and windshield washer fluid
- Home improvement products such as adhesives, caulk, paint, paint thinner, stain, and varnish
- Pesticides such as flea collars, insect repellent, insecticides, mothballs, pet sprays or dips, rat/mouse poison, and weed killer
- Household cleaners such as drain opener, furniture polish, oven cleaner, spot remover, toilet bowl cleaner, and tub/tile cleaner
- Aerosol cans, art and craft materials, cosmetics, lighter fluid, pool chemicals, and shoe polish

Appointments are limited to five gallons or fifty pounds per appointment. Motor oil must be in either one or two gallon containers with lids upon delivery to the Center. The HCCC is a convenient, drive-through facility. Appointments generally take an average of five minutes and the driver never leaves the car. Efforts are underway to extend the availability of the HCCC services to the remainder of Waste District O residents.

Information and Education Program

The City of Springfield provides informational and educational programs on the benefits of community waste reduction, including recycling. Information about Springfield's solid waste management system is presented through various activities such as the Recycling Hotline (864-1904); special events (e.g., Earth Day or America Recycles Day); informational brochures; service with local environmental, civic and service organizations, churches and businesses; educational kiosks; classroom materials, including curriculum guides, hand-outs and presentations. Information is also available on the City's web page and on Cable 23, the City's government access television channel. A tradeshow-style display is available for other shows and workshops.

Yardwaste Recycling Center

The Yardwaste Recycling Center (YRC) offers one-stop shopping for Springfield-Greene County residents. Residents can bring in their yardwaste (leaves, grass clippings, yard trimmings) or brush, and leave with high-quality compost or landscaping mulch. The services of the YRC are offered at no charge to Springfield residents. Those living outside of the city limits are advised of a suggested "honorary fee" of 50 cents per bag. Small quantities of yardwaste and brush are accepted at the in-town recycling centers (Lone Pine and Franklin) with a suggested donation to cover the hauling costs to the YRC. Yardwaste from commercial haulers or lawn services is accepted at no charge at the YRC; however, some limits and guidelines apply. Complete information is available from the Recycling Hotline or from the YRC/Recycling Cen-

ter brochure.

In the course of a year, approximately 150,000 cubic yards of yardwaste is processed at the YRC. Nearly 5,000 cubic yards of MO-Post compost and 50,000 cubic yards of MO-Mulch woodchip landscaping mulch are made available to area residents at the Center for use in their yards and gardens. Landscaping mulch is often offered free of charge. When available, compost can be purchased at the recycling center. Compost is in high demand with sometimes as many as 150 people on waiting lists between batches. The Recycling Hotline contains compost availability information.

Recycling Centers

There are four City-operated recycling drop-off centers in Springfield (731 North Franklin, 3020 South Lone Pine, 2525 West College, and adjacent to the YRC). The centers accept glass, plastic, tin/steel, aluminum, mixed paper, newsprint, cardboard, clothing, and textiles. Two locations, the North Franklin site and the Lone Pine site, accept yardwaste. The four centers handle approximately 536,000 pounds of materials per month, or 3,214 tons per year.

Market Development

As part of Springfield's Integrated Solid Waste Management System, the Market Development Program has several functions. Product supply development consists of innovative efforts to identify new recyclable materials, as well as increasing the quality and quantity of existing recyclables. One part of the Market Development Program is working with the City's economic development staff and the Springfield Area Chamber of Commerce to attract businesses and manufacturers that use recyclables to Springfield. One success story resulting from these efforts was the location of Canbrands Products Division of Ralston Purina Company in Springfield.

Another function of the Market Development Program is the identification of companies and manufacturers that use recycled materials. Also through Market Development, the Business Recycles program offers waste reduction assistance, and development or expansion of business recycling programs. City staff facilitates dialog between the supply source of the recyclable materials and potential end users.

Springfield Sanitary Landfill

While the emphasis of ISWMS is on waste reduction efforts, providing a local, convenient, affordable facility for environmentally safe and responsible solid waste disposal is a critical component of ISWMS. The Springfield Sanitary Landfill, located ten miles north of Springfield, sits on approximately 1,000 acres with 120 acres of active fill area. The large acreage provides a buffer between the facility and nearby residential areas. Today's modern landfill has a small area of exposed trash that is completely covered with six inches of soil or tarpaulins at

the close of each day. By doing this, odors are minimized and trash is not blown by the wind or scattered by animals. Modern management practices and technology are employed to ensure environmentally responsible and fiscally efficient operation of the disposal component of Springfield ISWMS.

Estimates are that the Springfield urban services area generates between 800 and 1200 tons of solid waste per day. Of this amount, 300 to 400 tons per day are received by the Springfield Sanitary Landfill, with the remaining waste hauled to out-of-town landfills. Revenues from the Springfield Landfill, primarily from tipping fees paid by solid waste haulers, support Springfield's Integrated Solid Waste Management System.

What Can You Do To Reduce Solid Waste?

The EPA advocates the practice of the three R's for producing less waste — reduce, reuse, and recycle. To *reduce*, simply means to consume and throw away less. Reducing waste also refers to the use of durable, long-lasting products that are not thrown away immediately after use. Reducing waste in these ways is the most effective method for producing less waste. Related is the concept of *reuse*, which refers to the ability to use a product more than once, often through selling, donation, or repair. The EPA lists several examples of reuse:

- Using durable coffee mugs in lieu of paper/styrofoam cups
- Using cloth napkins or towels in place of paper napkins/towels
- Donating old magazines and equipment
- Using empty jars for leftover food containers
- Purchasing refillable pens and pencils

The third “R”, *recycle*, differs from reuse in that a product has to go through reprocessing (for this reason, reuse is better). The EPA provides the following benefits of recycling:

- Conserves resources and saves energy
- Prevents emissions of many greenhouse gases and water pollutants
- Supplies valuable raw materials to industry
- Creates jobs
- Reduces the need for new landfills and incinerators

In order to maintain and create recycling programs, it is important that individuals purchase recycled products. As of now, more than 4,500 consumer products contain recyclable materials. The following list contains some of the most common products:

Aluminum cans
Carpeting
Motor oil
Trash bags
Glass containers

Laundry detergent bottles
Egg cartons
Newspapers
Cereal boxes
Paper towels

***FOR MORE INFORMATION ON THE SOLID WASTE MANAGEMENT ISSUES
DISCUSSED IN THIS CHAPTER, CONSULT THE FOLLOWING SOURCES...***

- *Barbara Lucks, Materials Recovery/Education Coordinator, 864-2005 or e-mail at <barbara_lucks@ci.springfield.mo.us>*
- *City of Springfield, Public Works Department, Division of Solid Waste Management Website at <<http://www.ci.springfield.mo.us/egov/publicworks/>>*
- *Recycling Hotline – 864-1904*
- *The United States Environmental Protection Agency Office of Solid Waste. Available at <www.epa.gov/osw/>*

SPRINGFIELD AND GREENE COUNTY

COMMUNITY HEALTH

Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop away from you like the leaves of autumn.

~ John Muir

Man's heart away from nature becomes hard.

~ Standing Bear

I love to think of nature as an unlimited broadcasting station, through which God speaks to us every hour, if we will only tune in.

~ George Washington Carver

The journey back to nature is also necessarily a journey into ourselves to remember who we are and what we believe.

~William Cronon

Did You Know?

- **In 2000, the City of Springfield's Planning Department identified approximately 120 boarded buildings and over 150 vacant and dilapidated buildings on the City's north side.**
- **Records since 1995 indicate that no Greene County restaurants outside incorporated Springfield have been closed as a result of failed inspections. Within incorporated Springfield, however, a total of 59 closings occurred within the same time period.**
- **Approximately three percent of housing in Greene County is at risk of having lead hazards**
- **Of 2,589 children tested in 2000, 47 (two percent) had elevated blood lead levels**
- **The Center for Disease Control has identified over 250 food borne illnesses. The most common enteric diseases in Greene County are campylobacteriosis, salmonellosis, shigellosis, hepatitis A, and *E. coli*.**

Introduction

Community health involves a wide range of issues. The issues in this chapter are of current priority in Springfield and Greene County. The first section of this chapter discusses the characteristics of a dangerous building, the dangers of these structures, and their prevalence in Springfield. The second section identifies populations at-risk for lead hazards and presents various data on elevated blood lead levels in Greene County children. Descriptions and data on the prevalence of food borne illnesses are examined in the next section. The food borne illnesses of concern include campylobacteriosis, salmonellosis, shigellosis, hepatitis A, and *E. coli*. The fourth section provides information on food establishment inspections conducted by the Springfield-Greene County Health Department. The next section of this chapter examines the issue of methamphetamines; specifically, dangers of usage, characteristics of household labs, and data on the number of DEA arrests and lab seizures in Greene County from 1996 to 2000. The concluding section is about the West Nile virus.

Unoccupied/Dangerous Buildings and Property

Boarded and unoccupied buildings present various problems, blighting neighborhoods and cities alike. These structures are responsible for safety hazards as they contribute to insect and rodent problems (e.g., rats, mosquitoes, etc.), endanger the public, and commonly serve as sites of criminal behavior. Any building that is detrimental to the health, safety, or welfare of residents is considered a public nuisance as defined in Section 26-62 of Springfield's municipal code. The following items are characteristics of a dangerous building:

- Structures with extreme leaning or buckling of interior walls or other vertical structural members
- Structures with deterioration of 33 percent or more of supporting members or 50 percent or more of non-supporting members
- Structures whose floors or roofs are overloaded or of insufficient strength
- Structures with sufficient damage caused by fire or wind
- Structures that are abandoned with open doors, windows, walls, or roofs
- Structures under construction that have had no substantial work done for 90 days after notice by the City
- Structures in the process of demolition that have had no substantial work done for 14 days after notice by the City to complete demolition
- Structures containing substantial amounts of garbage or other materials susceptible to fire or pests, and harmful to inhabitants or residents in the area
- Structures previously condemned as unfit for human habitation upon which no substantial work has been done to repair the condition
- Structures with poor escape capabilities in case of fire or other emergency
- Structures with deteriorated parts that may fall on public ways, on the property of others, or that may injure members of the public

- Structures built in violation of the City's building, plumbing, electrical, or zoning codes

A structure that meets any of these criteria may be posted with a public warning that it has been deemed dangerous by the City. If action is not taken by the property owner to remedy a dangerous building, the City may take steps to remove it. On the other hand, a vacant yet structurally sound building, that does not endanger the public, is required to be sufficiently boarded-up. Additionally, owners must obtain a boarded building permit.

The City of Springfield's Planning Department undertook a project in 2000 to determine the number of boarded and abandoned buildings on the City's north side. The north side was targeted due to its higher concentration of these structures in comparison to other areas of the City. The project, which extended north of Grand Street, identified approximately 120 boarded buildings and over 150 vacant and dilapidated buildings.

Lead Contamination

Lead contamination is a major environmental concern primarily due to its effects on children. The Centers for Disease Control and Prevention (CDC) has identified lead poisoning as the single most common and preventable health problem in children today. As a component of the Springfield-Greene County Health Department, the Springfield Lead Poisoning Prevention Program (SLPPP) provides various services addressing lead poisoning in the community. These services, which are provided at no charge for children under six years, include: lead screening, follow-up testing, environmental counseling and testing, nurse case management, medical referral, and distribution of lead-related information.

The Environmental Defense Scorecard reports that about three percent of all housing units in Greene County have a high risk of lead hazards. Two factors commonly associated with elevated blood lead levels in children are pre-1978 housing (although pre-1950s housing poses the greatest risk) and low-income housing. Nationally, CDC reports that 83 to 86 percent of houses built before 1978 are at risk of containing lead-based paint (the most common source of lead poisoning). The Consumer Product Safety Commission, in 1978, banned the use of lead-based paint from housing. Lead-based paint that is in good condition (no chips or other deterioration), generally, does not pose a safety risk. Lead-based paint is not residentially restricted if the levels of lead do not exceed 1.0 mg/cm². In addition to paint, other common sources of lead contamination are soil, dust, water, water pipes, vinyl mini-blinds, fishing sinkers, ammunition, and stained glass.

The second risk factor associated with lead poisoning in children is low-income housing, which comprises about 15 percent of all housing in Greene County. Between the years 1991 to 1994, CDC found that children in poor households were eight times as likely to be lead poisoned as children in high-income families.

Children under six years of age are more likely to be affected by lead contamination as

they exhibit more hand-to-mouth behaviors and their bodies absorb lead easier than adults. Health effects that may result from exposure to lead are: slowed growth, learning difficulties, hearing problems, hyperactivity, mental retardation, kidney disease, blindness, coma, and death. The Missouri Department of Health suggests lowering the risk of lead exposure by frequently washing children's hands and toys, having blood tested for lead, and having homes inspected. If it is determined that a home is a safety hazard due to lead contamination, then a certified lead abatement contractor may be needed to remove the lead.

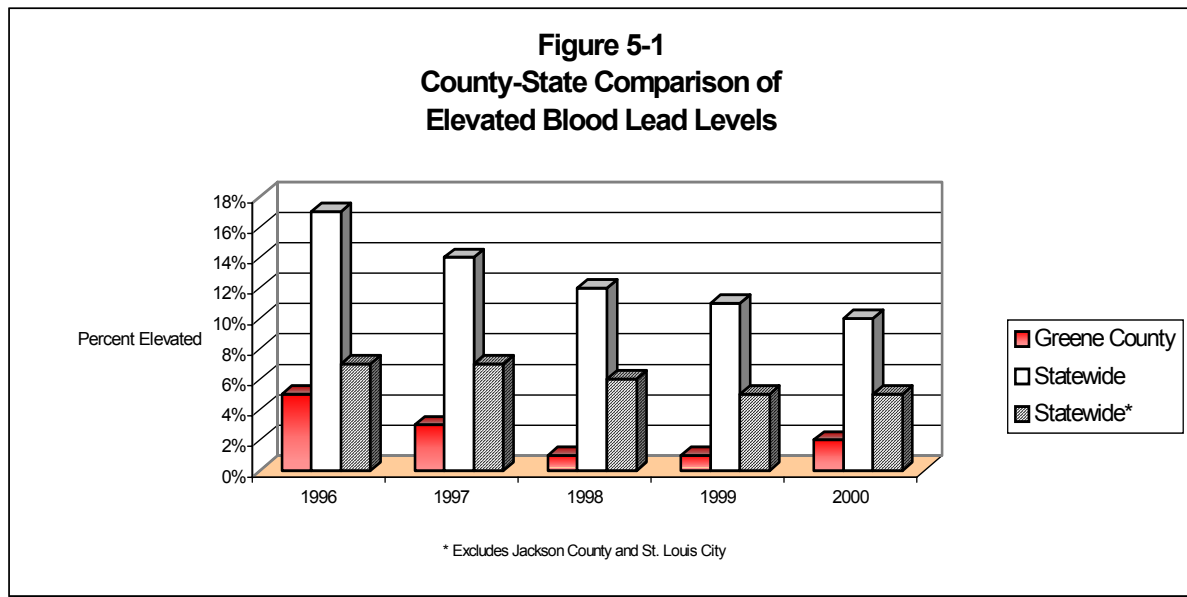
Lead screenings are administered to determine the amount of lead in a person's body. Table 5-1 shows elevated blood lead data for children six years of age and under in Greene County. Any lead in the body is considered foreign. By most standards, however, blood lead levels that exceed 10 micrograms per deciliter are considered elevated. As the data in the table indicate, the percentage of children tested with elevated blood lead levels decreased from 1996 to 2000 in Greene County.

Table 5-1: Elevated Blood Lead Levels in Greene County Children

	1996	1997	1998	1999	2000
Number Tested	2,767	2,864	2,880	2,861	2,589
Number Elevated	139	78	43	39	47
Percent Elevated of Number Tested	5%	3%	1%	1%	2%

Source: Missouri Department of Health

Figure 5-1 presents a comparison of elevated blood lead levels in children age six and under for both Greene County and the State of Missouri. The striped data set represents statewide elevated blood lead levels in children, excluding Jackson County (county in which Kansas City is located) and St. Louis City. Because their percentages skewed the data, the City of St. Louis and Jackson County were excluded from the third set to make comparisons with Greene County more reliable. The data above indicate that the percentage of children with elevated blood lead levels decreased from 1996 to 2000. In comparison with the State of Missouri, percentages of elevated blood lead levels in Greene County children were much lower.



Source: Missouri Department of Health

Several regulations exist to protect the public from lead poisoning in their homes. The Environmental Protection Agency and the Department of Housing and Urban Development are the two primary entities charged with protecting the public from lead hazards in the home. Following are some major regulatory concerns for renters and homeowners:

- Lead abatement is required by the Springfield-Greene County Health Department when it has been determined that a home has a child with elevated blood lead levels.
- The Lead Disclosure Rule (Title X, Section 1018) requires the disclosure of information on lead-based paint hazards before the sale or lease of targeted properties (properties built before 1978 with the exception of dwellings with no bedrooms, short-term rentals, housing for the elderly unless children can reside there, and inspected rental housing free of lead-based paint). Sellers and lessors of targeted properties are required to give purchasers and renters the EPA pamphlet *Protect Your Family from Lead in Your Home*.

- Sellers are not required to have their property inspected for lead hazards, however, they are required to give purchasers a ten-day period to have the home inspected.
- Although owners are not required to remove lead-based paint or paint hazards, they are required to disclose the information to buyers and renters.
- Lead-based paint is not residentially restricted if the levels of lead are lower than 100 milligrams/cm².

Food Borne Illnesses

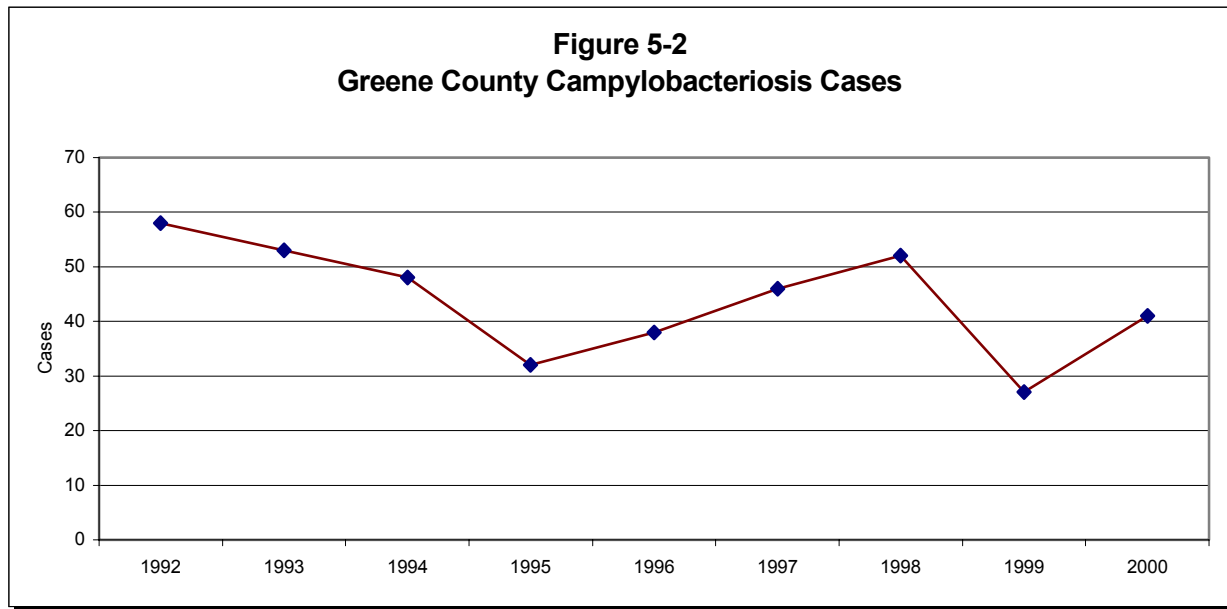
CDC has identified over 250 food borne diseases caused by bacteria, viruses, parasites, and manmade materials. Although symptoms of food borne illnesses vary, abdominal cramping and diarrhea are the most common. In Greene County, there are primarily five food borne illnesses: campylobacteriosis, salmonellosis, shigellosis, hepatitis A, and *E. coli* O157:H7. Each of these illnesses is discussed along with an accompanying graph that indicates the number of cases reported in Greene County from 1992 to 2000. Incidences of *E. coli* are reported for the period 1995 to 2000.

Campylobacteriosis

A bacterium that infects the intestines, *Campylobacter* is found in human and animal feces (especially cattle and chickens). Humans can contract *Campylobacter* by eating or drinking contaminated water, milk, poultry, meat, or from infected pets. Symptoms of campylobacteriosis are diarrhea, abdominal cramping, fever, nausea, and vomiting. Although treatment may require antibiotics, the illness often terminates on its own. Infected persons usually notice symptoms two to five days after exposure. Infection with *Campylobacter* bacteria can be prevented by properly cooking poultry and meat to at least 165 degrees and by thoroughly washing hands before and after handling raw foods. Additional measures that can be taken to prevent infection include thorough hand washing after restroom use and using pasteurized dairy products. Figure 5-2 shows campylobacteriosis cases in Greene County from 1992 to 2000. As the graph indicates, levels have fluctuated over the period.

Salmonellosis

Salmonella is a bacterium that affects the intestines and bloodstream. The infection, which is prevalent during the summer months, occurs through contact with infected persons, animals, and objects. Infection can result from eating or drinking contaminated food or water. *Salmonella* bacteria contaminate poultry and other raw meats, eggs, and unpasteurized dairy products. The bacteria are also found in reptiles, fowl, dogs, cats, and farm animals. Infected persons may carry the bacteria for several days or weeks. Those with diarrhea should be excluded from day care facilities, food service establishments, or other places where they put others at risk. Food handlers, children and staff in day care settings, and health care workers must obtain the approval of their local or state health department before



Source: Springfield-Greene County Health Department

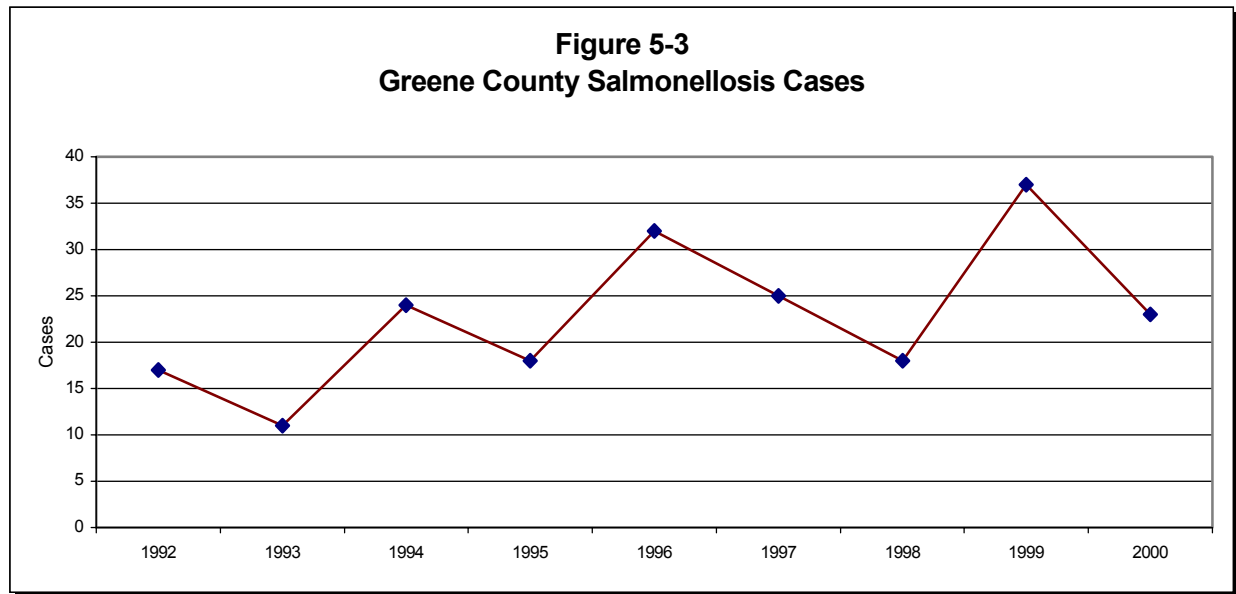
returning to their routine duties. Following are some tips for preventing infection by *Salmonella* bacteria:

- Thoroughly wash hands after restroom use.
- Thoroughly wash hands before and after handling food, especially raw meat.
- Thoroughly wash hands after handling animals or their feces (especially reptiles).
- Promptly refrigerate foods.
- Thoroughly clean cutting boards, utensils, or other foods that have come into contact with raw meat and poultry.
- Cook beef and pork to an internal temperature of 160 degrees Fahrenheit and poultry to an internal temperature of 185 degrees Fahrenheit.

Symptoms of salmonellosis, which usually occur 12 to 36 hours after exposure, are diarrhea, abdominal cramping, fever, nausea, vomiting, and headache. Most people with salmonellosis recover on their own without antibiotics. Increased fluid intake is usually advised in order to prevent dehydration. Figure 5-3 shows the number of salmonellosis cases in Greene County from 1992 to 2000.

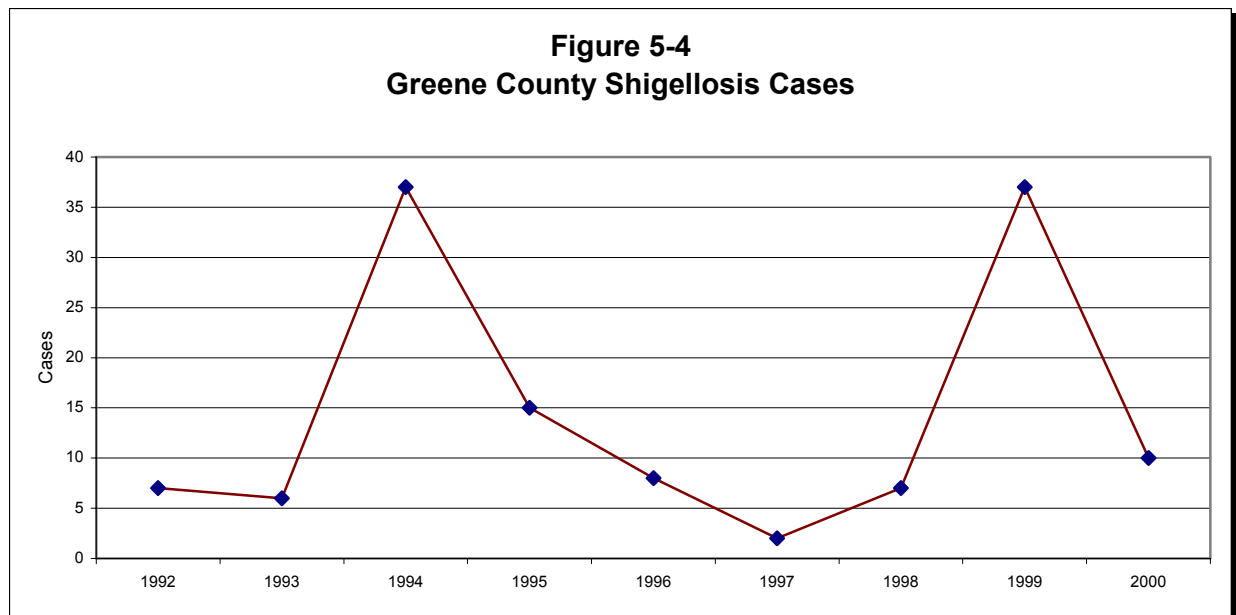
Shigellosis

A bacterial infection that affects the intestines, shigellosis most commonly affects children in day care centers, travelers to foreign countries, and homosexuals. *Shigella* bacteria are spread by eating or drinking contaminated food or water or by direct contact with infected persons. Symptoms common to shigellosis are diarrhea, abdominal cramping, fever, nausea, and vomiting. These symptoms usually begin to show one to three days after exposure, lasting four to seven days. Infected persons with diarrhea should be excluded from day



Source: Springfield-Greene County Health Department

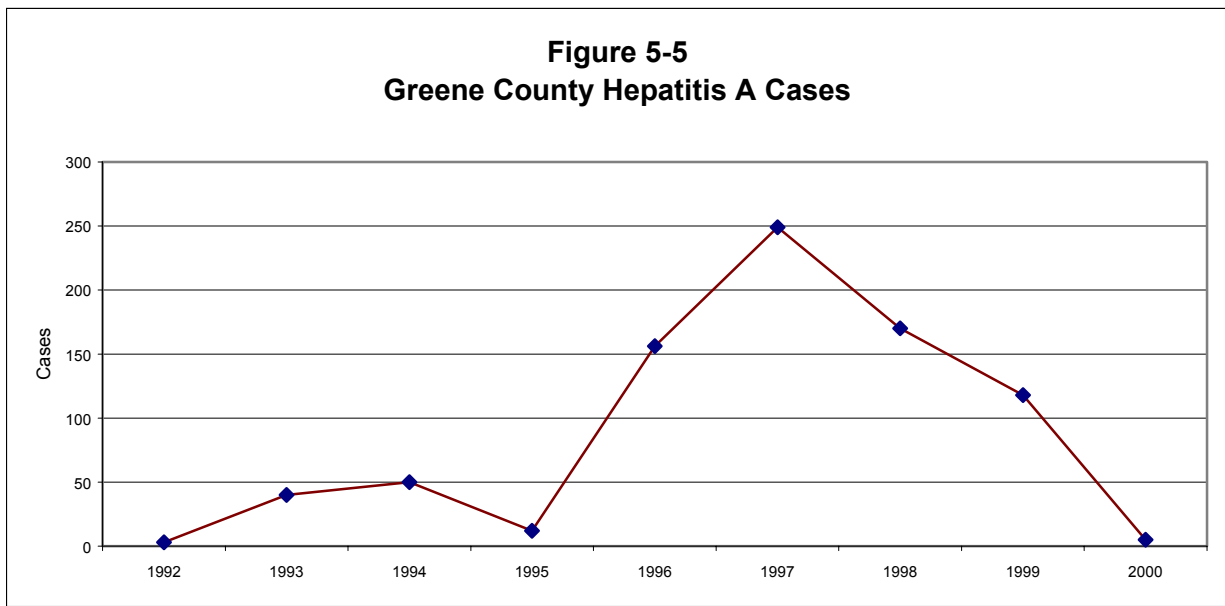
care facilities, food service establishments, or other places where they put others at risk. Once diarrhea subsides, infected persons may return to work or school provided they thoroughly wash their hands following use of bathroom facilities. Most people infected with *Shigella* bacteria recover on their own, although antibiotics are prescribed for more severe cases. Figure 5-4 shows the number of shigellosis cases that occurred in Greene County from 1992 to 2000.



Source: Springfield-Greene County Health Department

Hepatitis A

Hepatitis A is a liver disease caused by the hepatitis A virus. According to the Missouri Department of Health, from 1994 to 1998, there was an average of 1,032 cases in the State. Hepatitis A rarely causes long-term liver damage and usually is not fatal. Further, once the disease has been contracted, a lifelong immunity against future infection is developed. Although hepatitis A occurs more often in children, it is also common in young adults from 15 to 30 years of age. Hepatitis A is spread through feces and can be transferred by the hands if they are not properly washed after use of the restroom. Other common methods of transmission are drinking contaminated water and shared drug use with inhalable or injectable devices. The symptoms of hepatitis A, which usually occur from 15 to 50 days after exposure, include fatigue, poor appetite, fever, vomiting, dark urine, and jaundice. Rest and a good diet are the prescribed treatment for hepatitis A. Also, drugs and alcohol should be avoided. In order to have long-term protection from hepatitis A, vaccines can be administered. Short-term protection requires immune globulin injections. Figure 5-5 presents data on the number of hepatitis A cases in Greene County from 1992 to 2000.

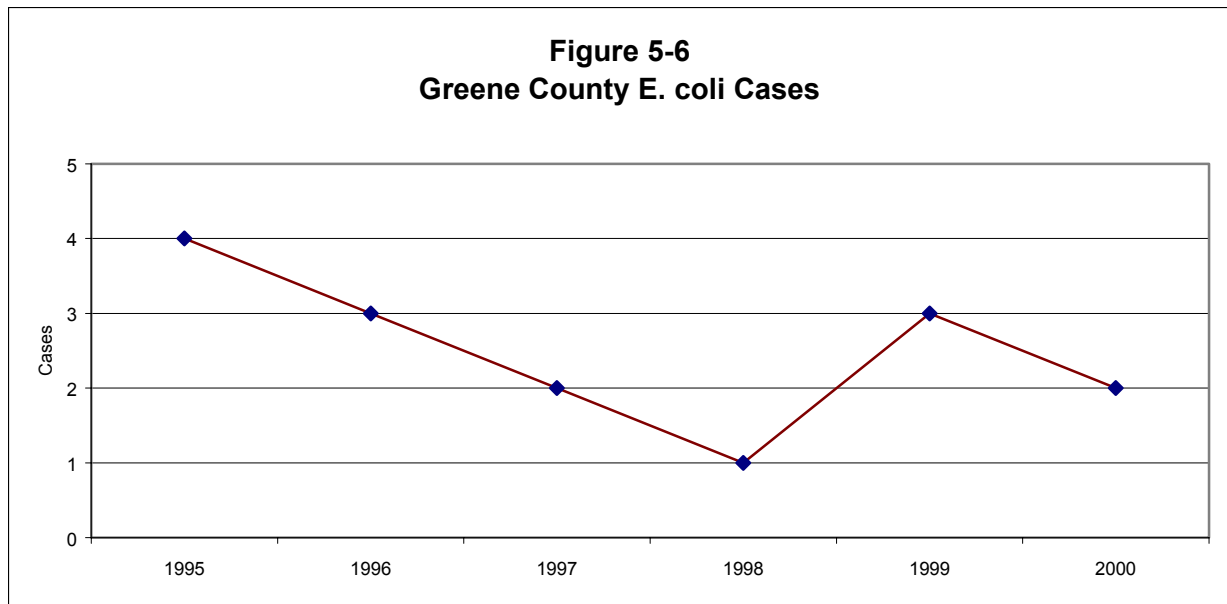


Source: Springfield-Greene County Health Department

E. coli

E. coli is a bacterium that lives in the intestines of humans and animals. One particular *E. coli* strain, O157:H7, causes severe diarrhea and kidney damage in humans. Symptoms caused by *E. coli* bacteria usually become apparent three days after exposure. The illness is acquired by drinking contaminated water or eating contaminated food. To avert exposure, it is important to adequately cook meat, use pasteurized dairy products, and promptly refrigerate food. Also, all surfaces and utensils in contact with raw meat should be thoroughly washed. Transmission also occurs through human contact when infected persons do not

wash their hands after using the restroom. Figure 5-6 shows the number of *E. coli* cases reported in Greene County from 1995 to 2000. As the data indicate, cases of *E. coli* are fairly low, below five cases annually.



Source: Springfield-Greene County Health Department

Food Establishment Inspections

The Springfield-Greene County Health Department conducts inspections of food establishments in both the City and County. Guidelines for food establishment inspections are regulated by the Missouri Department of Health. The State encourages food establishment inspectors to take an educational approach rather than a strict enforcement/regulatory approach. Barring any serious health hazards, if inspectors observe that restaurant owners are taking steps to comply with the rules, then a restaurant will likely not be closed. Both the City of Springfield and Greene County observe the inspection standards established by the State of Missouri.

Enforcement efforts differ, however, as Greene County officials observe State requirements and Springfield officials observe city ordinance requirements. Records since 1995 indicate that no Greene County restaurants outside incorporated Springfield have been closed as a result of failed inspections. Within incorporated Springfield, however, several food establishments have been closed due to failed inspections. In 1995, there was 1 closing, 4 in 1997, 8 in 1998, 11 in 1999, 11 in 2000, and 24 in 2001, for a total of 59.

Officials inspect food establishments under a new food code, formally put into effect on July 22, 2001. The former food code required inspectors to assess 44 areas, scoring inspections on a percentile basis. The new system eliminated percentile scoring and based assessment on over 450 items. The new food code, while stricter, is better for consumers as it re-

quires employees of food establishments to take proactive efforts in food preparation and service. Additionally, the new requirements increase managerial responsibility by requiring continued education on food safety issues. Lastly, the new code takes a science-based approach, based on inspection outcome through risk ranking, hazard analysis, and critical thinking.

Code violations are categorized and documented on the *Food Establishment Inspection Report* as either critical or non-critical. Critical items are more serious violations, such as those that may lead to food borne illnesses. Non-critical items are less serious, such as maintenance or cleanliness. A restaurant with one or more critical item violations must take corrective action within 72 hours. Non-critical item violations must be corrected before the next inspection or as stated. Food establishments in Greene County receive at least one inspection per year. The number of inspections depends upon the menu, methods of preparation, sanitary conditions, and type of food establishment. All establishments in the City of Springfield (where establishments must also purchase a food permit) serving food are inspected at least twice per year. In both the City and County, establishments that continually violate the code may be inspected more than the required number of times.

Methamphetamines

According to the 1999 National Household Survey on Drug Abuse, an estimated 9.4 million Americans have experimented with methamphetamines (also referred to as meth, speed, ice, or crystal) in their lifetimes. The Drug Enforcement Administration reports that meth is the fastest growing drug threat in the country. In 1999, Missouri had the third largest number of drug lab busts (the largest majority of which were meth related) in the country, behind California and Washington. In Greene County, an awareness of methamphetamines as a community health threat continues to grow among government officials, law enforcement personnel, and citizens.

Meth can be smoked, snorted, injected, or taken orally. As a central nervous system stimulant, methamphetamine usage may increase one's heart rate, blood pressure, body temperature, and rate of breathing. Hyperactivity, euphoria, increased energy, tremors, irritability, and violent behavior are also characteristics of meth use. Chronic abusers may have schizophrenia-like symptoms such as paranoia and auditory/visual hallucinations.

Table 5-2 shows the number of lab seizures and arrests reported by the DEA in Greene County for the years 1996 through 2000. Excluding the 2000 figure, meth lab seizures in Greene County increased over the period. After annual increases from 1996-1998, meth related arrests in Greene County declined for 1999 and 2000. The total number of lab seizures for the period was 245, while the total for arrests was 846.

Table 5-2
DEA Methamphetamine Data for Greene County,
1996-2000

	Lab Seizures	Arrests
1996	7	57
1997	15	148
1998	58	337
1999	111	224
2000	54	80
TOTAL	245	846

Source: Drug Enforcement Administration

The Greene County Sheriff's Department has compiled a list of characteristics to help identify household methamphetamine labs:

- Propane tanks with fittings that have turned blue
- Jars containing clear liquid with a white colored solid on the bottom
- Traffic coming and going often
- Unusual chemical smells like ether, ammonia, or acetone
- Coffee filters containing a white pasty substance or a dark red sludge
- Jars or sealed cans with tubing attached
- Lithium batteries stripped/disassembled
- Strong odor similar to urine
- Glass cookware containing a powdery residue
- Unusual number of trash fires

West Nile Virus

Currently, the Springfield-Greene County Health Department is contracting with the Missouri Department of Health and the U.S. Centers for Disease Control and Prevention to surveil for the West Nile virus. The West Nile virus, which is transmitted by mosquitoes, can manifest into fatal encephalitis (inflammation of the brain) in humans, horses, and certain domestic and wild birds. Most persons infected with this virus show no symptoms, although occasional infections can result in serious illness and death.

The Springfield-Greene County Health Department has been active in the collection of dead crows, jays, and hawks, as these species are susceptible to the virus. To date, the Springfield-Greene County Health Department has collected a total of nine birds found dead

in the region. Of the nine birds, five blue jays, three crows, and one hawk were collected. Birds are sent to Madison, Wisconsin, to be tested for West Nile virus. Thus far, none of the collected specimens from this area have tested positive for West Nile virus.

Through July 2001, according to CDC, incidences of West Nile virus have been reported in Connecticut, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Florida, Georgia, Virginia, Ohio, and the District of Columbia. More recently, birds have tested positive for West Nile virus in Little Rock, Arkansas, and St. Louis, Missouri. It is anticipated that the virus will be discovered in the southwest region of Missouri within the next calendar year.

To protect against West Nile virus, persons should limit their exposure to mosquitoes. Because mosquitoes are most active at dawn and dusk, persons who are outdoors during these times should wear long-sleeved shirts and long pants. In addition to this, clothing can be sprayed with insect repellent that contains permethrin or DEET. One method for controlling mosquito populations around the home is to eliminate standing water. Removing old tires around the home, for example, will reduce mosquito populations since tires hold water. Also, screens can be placed over doors and windows to reduce the potential for mosquitoes entering the home.

***FOR MORE INFORMATION ON THE COMMUNITY HEALTH ISSUES DISCUSSED
IN THIS CHAPTER, CONSULT THE FOLLOWING SOURCES USED IN THIS
ASSESSMENT...***

- *Centers for Disease Control*
Website at <<http://www.cdc.gov>>
- *Drug Enforcement Administration, United States Department of Justice*
Website at <<http://www.dea.gov>>
- *Environmental Defense Scorecard*
Website at <<http://www.scorecard.org/env-releases/lead/>>
- *Environmental Protection Agency*
Website at <<http://www.epa.gov>>
- *Greene County Sheriff's Department*
Website at <<http://www.greenecountymo.org/Sheriff/>>
- *Housing and Urban Development*
Website at <<http://www.hud.gov>>
- *Missouri Department of Health*
Website at <<http://www.health.state.mo.us>>
- *Springfield-Greene County Health Department*
Website at <<http://www.ci.springfield.mo.us/health/>>

SPRINGFIELD AND GREENE COUNTY

**ENVIRONMENTAL JUSTICE AND
ENVIRONMENTAL EDUCATION**

What are the natural features which make a township handsome? A river, with its waterfalls and meadows, a lake, a hill, a cliff or individual rocks, a forest, and ancient trees standing singly. Such things are beautiful; they have a high use which dollars and cents never represent. If the inhabitants of a town were wise, they would seek to preserve these things, though at a considerable expense; for such things educate far more than any hired teachers or preachers, or any at present recognized system of school education. I do not think him fit to be the founder of a state or even of a town who does not foresee the use of these things...

~ Henry David Thoreau, 1861

Look deep into nature, and then you will understand everything better.

~ Albert Einstein

Nature is the symbol of the spirit.

~ Ralph Waldo Emerson

You must not know too much or be too precise or scientific about birds and trees and flowers and watercraft; a certain free-margin, and even vagueness - ignorance, credulity - helps your enjoyment of these things.

~ Henry David Thoreau

Did You Know?

- **To ensure that environmental justice is served, the City of Springfield has sought the involvement and participation of at-risk populations in redevelopment decisions involving the Jordan Creek Corridor.**
- **Ninety-six percent of American adults support the instruction of environmental education in schools.**
- **The Missouri Department of Natural Resources reports that environmental topics comprise 30 percent of schools' science and social studies frameworks, and 21 percent of the communication arts framework.**
- **Service learning opportunities are an ideal way to promote environmental education. Examples of environmental service learning programs and opportunities include: working to preserve native plants, testing local water quality, developing urban community gardens, initiating school/business recycling programs within communities, and on a local basis, providing environmental science instruction by teachers in training from Southwest Missouri State University and Drury University.**
- **There is a wealth of environmental education opportunities available to the public within our community. Please consult the Springfield Area Directory of Environmental Agencies and Organizations (in the appendix to this assessment) for topic and contact information on these opportunities.**

Introduction

Environmental justice and environmental education are significant issues both locally and nationwide. Environmental justice means ensuring equitable treatment among all persons with respect to environmental issues. Environmental education is, in a basic sense, teaching people to better care for the environment so that future generations may enjoy it. The first section of this chapter discusses environmental justice — definitions, legislation, and local efforts to ensure environmental justice in the redevelopment efforts of the Jordan Creek Corridor. The remaining sections examine environmental education, state environmental education programs, and service learning opportunities. A list of environmental service learning publications and programs is provided at the end of this chapter. Contact information is given for those interested in obtaining further information on the publications and programs listed.

Environmental Justice

During the 1970s, the United States witnessed an influx in concern over environmental issues. This concern was primarily the result of widespread pollution and environmental degradation in the U.S. The passage of the Environmental Protection Act of 1970 (this act established the Environmental Protection Agency) was a primary example of this move to address rising concerns of environmental degradation. Government at all levels during this period, however, failed to address issues of equity, civil rights, and social justice in their environmental regulations and policies. As a result, negative issues such as poverty and racism extended into the environmental quality arena. Moreover, low-income and minority communities have increasingly been exposed to hazardous sites such as waste facilities, polluting industries, chemical manufacturing plants, highways, and landfills. Consequently, persons in these at-risk communities become highly susceptible to injury, disease, and death.

The environmental justice movement began, primarily, in response to these inequities. Ensuring more equitable treatment with respect to improving environmental quality has only recently become a government priority. The Environmental Protection Agency's Office of Enforcement and Compliance Assurance states the following in regard to environmental justice:

Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies.

In 1994, President Clinton signed *Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations)* to set a federal goal of achieving environmental protection for all communities. The order states that

“each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” The order also requested that agencies provide information and opportunities for public participation in matters concerning the environment and human health. As an example, the EPA outlined the following four actions in its commitment to ensuring environmental justice for all persons:

- (a) Conducting our programs, policies, and activities that substantially affect human health and the environment in a manner that ensures the fair treatment of all people, including minority populations and/or low-income populations;
- (b) Ensuring equal enforcement of protective environmental laws for all people, including minority populations and/or low-income populations;
- (c) Ensuring greater public participation in the Agency’s development and implementation of environmental regulations and policies; and
- (d) Improving research and data collection for Agency programs relating to the health of, and the environment of all people, including minority populations and/or low-income populations.

In Springfield and Greene County, environmental justice is mainly a concern with regard to lead hazards in and around the home. Low-income residents are more likely to live in homes with lead hazards, which puts them at a greater risk for elevated blood lead levels when compared to higher income families living in newer homes. Another community-related environmental justice issue relates to the Jordan Creek Corridor. As part of the Vision 20/20 Redevelopment Plan, the City has sought the involvement and participation of residents in the Corridor for input into redevelopment plans. By distributing flyers and public notices in strategic areas, officials hope to engage residents in the Corridor to ensure that environmental justice is served. Residents in the Jordan Creek Corridor stand to benefit from redevelopment efforts through improved quality of life and jobs from new business developments expected in the revitalized area. Additional environmental justice measures have been taken in other sections of Springfield, particularly the City’s north and west sections.

Environmental Education

Broad public support continues to flourish in the area of environmental education. According to a 1997 Roper Survey, 96 percent of adults in the United States support the instruction of environmental education in schools. The popularity of environmental education increased subsequent to the 1990 passage of the National Environmental Education Act, which helped to make environmental education a national priority. The Act called for the EPA to make environmental education an integral part of its move to protect the environment.

The EPA defines environmental education as “a lifelong learning process aimed at developing an environmentally literate citizenry that has the knowledge, skills, and commitment to make responsible decisions that impact environmental quality.” The Missouri Environmental Education Association defines environmental education as “an active process that in-

creases awareness, knowledge, and skills that result in understanding, commitment, informed decisions and constructive action to ensure stewardship of all interdependent parts of the Earth's environment." More simply, the basic goal of environmental education is to teach younger generations to better care for the environment than adults do now.

The EPA promotes environmental education as a result of its integral role in protecting human health, advancing quality education, creating jobs in the environmental field, incorporating environmental protection into economic development, and encouraging effective natural resource management. Additionally, environmental education is important because a well-trained and prepared workforce is needed to adequately handle the complex environmental challenges of the future. The EPA advocates an increase in environmental education for both children and adults. Large increases in the number of school and community programs have been observed throughout the United States over the last decade. The increase is attributed to growing concerns over environmental quality and protection.

The idea behind environmental education is that it should present unbiased views of all competing interests involved in environmental issues (e.g., pro-environment causes and pro-industry causes). By presenting environmental issues in an unbiased manner, the individual student is left the responsibility of deciding what is right or wrong. A common theme in environmental education is that students are taught how to think about environmental issues, not what to think. Several communities in the U.S. have experienced a great deal of conflict among environmental interests and business/industry interests. One example, often discussed in the media, is the ongoing troubles surrounding preservation of the Alaskan wilderness and oil interests. Locally, however, Springfield is fortunate to have the support of several businesses and industries in maintaining a healthy balance between environmental education and economic vitality.

In 1996, the Missouri State Board of Education set forth four goals to be accomplished in schools throughout the State. The goals comprise what has been termed the Show-Me Standards. The four goals state that students in Missouri public schools will acquire the knowledge and skills to: (1) gather, analyze and apply information and ideas; (2) communicate effectively within and beyond the classroom; (3) recognize and solve problems; and (4) make decisions and act as responsible members of society. Instruction in environmental education provides an ideal forum for meeting the goals of the Show-Me Standards, since proper training in environmental education encourages the use of the same skills (e.g., critical thinking, problem solving, decision making, etc.) within its students. Furthermore, environmental issues are a popular theme in Missouri's Frameworks for Curriculum Development. The Department of Natural Resources reports that environmental topics comprise 30 percent of schools' science and social studies frameworks, and 21 percent of the communication arts framework.

The Missouri Environmental Education Association (MEEA) seeks to develop an environmentally responsible citizenry in Missouri by advancing environmental education through professional development and partnership opportunities. MEEA provides a certification program through which educators are recognized for attaining a certain level of profi-

ciency in environmental education. MEEA seeks to accomplish several goals through its certification process: provision of educational programs to improve technical competency among environmental educators; provision of incentives to encourage continued professional development; and, provision of standards by which professionals who demonstrate a certain level of competency may be recognized. Maintaining certification requires that educators continue professional development in order to keep abreast of new skills and knowledge in the environmental education field.

MEEA provides information to assist in the development of local and community environmental education programs and projects. Also, MEEA provides lesson plans and teaching aids to environmental educators, information on funding and resources available for environmental education, as well as a forum for sharing knowledge and resources related to environmental education. Additional information about MEEA can be obtained at www.meea.org or by e-mail at membership@meea.org.

The Missouri Department of Natural Resources Information and Education Office offers many services related to environmental education. Some of these services include consulting for teachers and schools; providing graduate-level college courses and in-service training; sponsoring Project WET (discussed below); facilitating Project WET, Project WILD, Project Learning Tree, and the Leopold Project; and distributing environmental education materials to schools and at conferences. Additional information about environmental education assistance provided through the Missouri Department of Natural Resources Information and Education Office is available by contacting:

Missouri Department of Natural Resources
Information and Education Office
Environmental Education
P.O. Box 176
Jefferson City, MO 65102-0176
Phone 1-800-361-4827 or
(573) 526-6627
FAX (573) 526-5808
Home page: www.dnr.state.mo.us/deq/tap/hometap/htm

Environmental Education Programs

Typically, the focus of environmental education programs is to teach students not what to think, but rather, how to think about environmental issues. Environmental educators ideally take a middle-of-the road approach, presenting facts on both sides of environmental issues. By doing this, instructors enable students to think and make decision for themselves. Following are some environmental education opportunities/programs available in Missouri.

Conservation Seeds: An early childhood conservation education program that enables teachers to better educate young children on conservation and the environment. Information

about *Conservation Seeds* education materials and workshops is available through the Missouri Department of Conservation at (717) 895-6880, ext. 1068.

Project WET (Water Education for Teachers): A program that seeks to “promote awareness, appreciation, knowledge, and stewardship of water resources through the development and dissemination of classroom-ready teaching aids and through the establishment of state and internationally sponsored Project WET programs.” Information about *Project WET* can be obtained through the Missouri Department of Natural Resources at 1-800-361-4827.

Project Learning Tree: A program that utilizes hands-on activities to teach students about trees, soil, water, wildlife and solid waste. *Project Learning Tree* consists of a Pre-K-8 program and a secondary education program. The secondary program presents an expanded focus in which such topics as forest ecology, solid waste management, and risk assessment are studied. Information on *Project Learning Tree* can be obtained through the Missouri Department of Conservation at (573) 751-4115, ext. 113.

Project Wild: A program that seeks to teach students from K-12 about wildlife, habitats, and ecosystems. *Project Wild* uses hands-on activities that are designed to teach students how to think critically about wildlife issues. The program is considered ideal for teachers, naturalists, camp counselors, and youth group leaders. Information on *Project Wild* can be obtained through the Missouri Department of Conservation at (573) 751-4115, ext. 113.

The Resource for Environmental Education in Missouri: A quarterly newsletter that provides information on conservation and environmental education resources, events, methods, and recommendations that teachers can use to incorporate environmental education into their instruction. The newsletter is also a forum for environmental education and networking in Missouri. Subscriptions to the newsletter are free and obtainable by writing the Office of Environmental Education, Missouri Department of Conservation, P.O. Box 180 Jefferson City, MO 65102-0180.

Investigating and Evaluating Environmental Issues and Actions (IEEIA): IEEIA is a national model for investigating environmental issues. This environmental education course is offered by the Missouri Department of Natural Resources. For 2002, the IEEIA course will be offered June 23-28 at the Jerry J. Presley Conservation Education Center near Eminence, Missouri. Teams of three to four persons choose an environmental issue as a framework for understanding the issue investigation process. To register, contact the Missouri Department of Natural Resources, Outreach and Assistance Center, Environmental Education, P.O. Box 176, Jefferson City, MO 65102-0176. For more information, call MDNR at 1-800-361-4827 or (573) 526-5805.

Service Learning and Environmental Education

Although no concrete definition exists for the term service-learning, most definitions posit that service learning is the provision of opportunities for students to engage in work ex-

periences beneficial to schools, communities, and society, while simultaneously gaining helpful knowledge and skills. Service learning programs can be found at all levels of education, but is most prevalent in high schools and colleges. The Corporation for National Service uses the definition provided in the National and Community Service Trust Act of 1993, which describes service-learning as an educational method:

- Under which students or participants learn and develop through active participation in thoughtfully organized service that is conducted in and meets the needs of a community;
- Which is coordinated within an elementary school, secondary school, institution of higher education, or community service program, and with the community;
- Which helps foster civic responsibility;
- Which is integrated into and enhances the academic curriculum of the students, or the educational components of the community service program in which the participant is enrolled;
- Which provides structured time for students or participants to reflect on the service experience.

The National Service Learning Clearinghouse (NSLC) indicates that student participation in service learning has witnessed tremendous growth, especially in high schools. The number of high school students engaged in service learning expanded about 3700 percent from 1984 to 1997, according to NSLC. Currently, approximately 30 percent of college students at four-year institutions report participating in a service-learning program through their universities. Almost half of all community colleges in the country offer service learning programs.

Service learning programs are important as they have been linked to increased student academic achievement and increased school attendance. Furthermore, service learning teaches students many important skills such as teamwork, communication, and responsibility. Service learning opportunities take many forms, such as designing neighborhood playgrounds, teaching younger children to read, and preparing food for the homeless. Examples of environmentally-related service learning programs are working to preserve native plants, testing local water quality, developing urban community gardens, and initiating school/business recycling programs. Locally, environmental science instruction is provided by teachers in training from Southwest Missouri State University and Drury University.

Following is a list of various service learning publications/programs (as listed in the NSLC service learning directory) related to environmental education. Contact information has also been provided so that information can be obtained on available opportunities.

Service-Learning Publications

Publication: Acting Locally: Concepts and Models for Service Learning in Environmental Studies: Harold Ward, 1999, 214 pages

Description: Acting Locally: Concepts and Models for Service-Learning in Environmental Studies contains sixteen articles from practitioners from a range of colleges, universities, and one community college, who are involved in Environmental Studies Service-Learning (ES/SL)

programs. The authors describe the programs and/or courses in their schools by including a brief history of the program, class objectives and agendas, and impacts on students, teachers, and the community. Many authors also address more practical considerations such as student assessment and timelines. The appendix includes a bibliography and biographies of contributing authors.

Address: American Association for Higher Education
Publications Order Desk
Box WES7
Washington, DC,
Phone: 202-293-6440 x11

Publication: Environmental Service Learning: Kirk Brown, 1996, 46 pages

Description: This guide provides information to teachers about how and why to start an environmental service learning program. Includes a list of resources on environmental service learning.

Address: Tree Trust
6300 Walker Street
St. Louis Park, MN 55416
Phone: 612-920-9326

Publication: Give Water a Hand Action Guide and Leader Guidebook
University of Wisconsin Board of Regents, 1995
Action Guide: 70 pp.; Leader Guidebook: 36 pp. pages

Description: Students in grades 4-8 can use this guide to explore the topics of water and water conservation within a community, while conducting an environmental community service project. The Action Guide instructs students in observing, researching needs, mapping a watershed, asking experts for help, choosing a project, planning, staying on track and celebrating success. The leader's guide provides an overview, goals for each step of the project, service learning strategies, leader's skills, possible project partners and tips for adapting the project to other audiences.

Address: University of Wisconsin Extension, Cooperative Extension
Environmental Resources Center
College of Agriculture and Life Science
Madison, WI 53706
Phone: 800-928-3720

Publication: Making a Difference: Service Learning as a Solid Waste Education Experience
Environmental Protection Agency, 1998, 22 pages

Description: The publication includes descriptions and contact people for 17 environmental service learning projects. The examples come from throughout the United States and are performed by elementary and middle school students. They range from environmental cleanup projects to production of media forms to educate local people about studies on community waste disposal. The author also includes contact information and descriptions of organizations to help implement service learning and environmental cleanup.

Address: Environmental Protection Agency
Office of Solid Waste
401 M Street SW, Mailstop 5305W
Washington, DC,
Phone: 1-800-424-9346

Publication: National Partners: Service Learning and Environmental Education.
Mississippi State Department of Education, 1996, 43 pages

Description: The purpose of the publication is to introduce service-learning as a teaching methodology, define environmental education, and demonstrate how service-learning and environmental education can be interrelated. Contains lesson plans to help teachers integrate hands-on projects.

Address: Mississippi Department of Education
Office of Community and Outreach Services
PO Box 771
Jackson, MS 39205-0771
Phone: 601-359-3598

Publication: Take a Class Outdoors: a Guidebook for Environmental Service-Learning.
Linda Clifton; Rebekah Falker, 1998, 27 pages

Description: This guide was written by the principal, a teacher, and a former student from Booneville Middle School in Mississippi. Booneville Middle School has integrated an environmental service-learning program for their fifth through eighth grade classes. The guide provides information on how to implement such a program into a curriculum from the perspective of the teacher and administrator. The guides also features the student's perspective.

Address: National Dropout Prevention Center
Clemson University
209 Martin Street
Clemson, SC 29634-0726
Phone: 864-656-2599

Publication: Teacher's Guide to Environmental Service Learning.

Harry C. Silcox, 1995, 39 pages

Description: This guide describes three types of environmental service-learning projects: conservation/preservation, energy audits, and environmental monitoring/technological education. Projects in each area are detailed and academic links are clearly defined.

Address: Brighton Press, Inc.

64 Lempa Rd

Holland, PA 18966

Publication: Topic Bibliography on Sources Related to Service and the Environment.

Robin C. Vue-Benson; Robert Shumer, 1994, 5 pages

Description: Lists resources providing information about service learning in environmental education.

Address: National Service-Learning Clearinghouse

University of Minnesota

R460 VoTech Ed Building, 1954 Buford Avenue

Saint Paul, MN 55108-6197

Phone: 1-800-808-7378

Publication: Training Student Organizers Curriculum, Revised Edition.

Michael Zamm, 1990, 260 pages

Description: Between 1979 and June 1990, the Training Student Organizers (TSO) Program has motivated nearly 7,400 students and their teachers to organize over 260 environmental improvement projects serving their schools and neighborhoods in the New York City area. The projects run the gamut from clean up campaigns, murals and letter writing efforts to energy conservation. This document presents the curriculum from the TSO Program including lessons on many topics including energy conservation, solid waste, water, air, open space beautification and preservation, noise pollution, nuclear energy and transportation; and teaching suggestions and process goals including "The Rationale for Citizen Participation," "Needs Assessment and Project Selection," "Project Planning and Initial Field Organizing," "Project Monitoring and Ongoing Participation Strategies," "Evaluation," and "Letter Writing and Petitioning" (ERIC).
ERIC No. ED328424

Address: Council on the Environment of New York City

51 Chambers St

Room 228

New York, NY 10007

Phone: 212-788-7900

Fax: 212-788-7913

Publication: YES Youth Environmental Service: Technical Assistance Package, 1996, 68 pages

Description: The Youth Environmental Service (YES) aims to rehabilitate adjudicated delinquents and to prevent at-risk youth from entering the juvenile justice system by engaging them in environmental work and education programs on federally owned land. YES is a joint program of the U.S. Department of the Interior (DOI) and the Office of Juvenile Justice and Delinquency Prevention (OJJDP). Key elements of the program are involvement of at-risk or delinquent youth; a partnership between a youth-serving agency and a federal land management agency; availability of federal land; a provider experienced in working effectively with at-risk or delinquent youth; a clear allocation of responsibilities; and the provision of meaningful opportunities for youth to learn new skills, develop a sense of accomplishment, and make contributions to the environment. This document includes an overview of the YES initiative; what the program can offer; developing YES partnerships; steps to becoming a YES site; implementation issues; technical assistance resources from OJJDP and DOI, including required information sharing; federal contacts for the program; and resources for further assistance. Appendices include the memorandum of understanding between the U.S. Department of Justice and DOI, profiles of YES programs in action, definitions, sample memorandums of understanding and agreement, information on state resources, a list of contacts at current YES sites, and a technical assistance request form. (TD)

ERIC No. ED402112

Web Site: www.ncjrs.org/pdffiles/yestap.pdf

Address: Juvenile Justice Clearinghouse (NCJRS)

P.O. Box 6000

Rockville, MD 20849-6000

Phone: 800/638-8736

Publication: YMCA Earth Service Corps Club Handbook, 1998, 73 pages

Description: This handbook provides Young Men's Christian Association (YMCA) Earth Service Corps club leaders and advisors with ideas for structuring clubs and service-learning projects. Activities and suggestions help to plan out the year, and improve service projects and club meetings. Contents include: (1) "What is YMCA Earth Service Corps?"; (2) "The Four Program Components"; (3) "A Recipe for Starting Your Own Earth Service Corps Club"; (4) "The Earth Service Corps Partnership"; (5) "Club Development"; (6) "Introduction to Weekly Club Outlines"; (7) "Fundraising"; (8) "Service Learning"; (9) "Leadership Development"; (10) "Environmental Education"; (11) "Planning Service-Learning Projects"; (12) "Community/Environmental Resource Mapping"; (13) "Cross-Cultural Awareness"; (14) "Evaluating Your Club"; and (15) "Evaluating This Handbook." An appendix includes a YMCA parent information sheet. (CCM)

ERIC No. ED432478

Address: YMCA Earth Service Corps National Resource Center

909 Fourth Ave.

Seattle, WA 98104

Phone: 206-382-5013 x5095

Service-Learning Organizations & Events

Program: Eco Education

Description: Eco Education is a nonprofit organization committed to making environmental education relevant to urban learners and to helping them address their unique environmental concerns.

Address: Eco Education
275 East Fourth Street #821
216 Agriculture Hall
Saint Paul, MN 55101
Phone: 651-222-7691

Program: Give Water a Hand

Description: Give Water A Hand is a national watershed education program designed to involve young people in local environmental service projects.

Address: Give Water a Hand
1450 Linden Drive
Madison, WI 53706
Phone: 800-928-3720

Program: Hands On the Land

Description: Created by a Learn and Serve America sub-grantee, this site provides a national network of field classrooms to enhance the learning of students from kindergarten through high school. Through on-line exchanges, virtual tours, and satellite broadcasts, students and teachers are sharing information about their local ecosystems, creative teaching strategies, and more.

Email: support@HandsontheLand.org
National Association of Service & Conservation Corps (NASCC)
NASCC unites and supports youth corps as a preeminent strategy for achieving the nation's youth development, community service and environmental restoration goals.
Address: National Association of Service & Conservation Corps (NASCC)
666 11th Street, N.W.,
Suite 1000
Washington, DC, 20001
Phone: 202-737-6272

Program: National Tree Trust

Description: The NTT mobilizes volunteer groups, promotes public awareness, provides grants, and unites civic and corporate institutions in support of local tree planting and education projects throughout the United States. One of their programs, Growing Together, educates and involves pre-kindergarten through 6th-grade school children in the growth and planting of trees in their communities.

Address: National Tree Trust
1120 G Street NW
Suite 770
Washington DC, 20005
Phone: 202-628-8733

Program: YMCA Earth Service Corps National Resource Center

Description: YMCA Earth Service Corps is a service-learning program for teens ready to make a difference in their communities. Grounded on the building blocks of leadership development, environmental education and action, and cross-cultural awareness, this proven program works in diverse communities and allows teens to use their talents, develop new skills and learn more about themselves and their surroundings. YMCA Earth Service Corps is operating in 111 YMCAs in 30 states and continues to be a fast growing national program for the YMCA.

Address: YMCA Earth Service Corps National Resource Center
909 Fourth Ave.
Seattle, WA 98104
Phone: 206-382-5013 x5095
Program: The Student Conservation Association (SCA)

Description: SCA is America's largest and oldest provider of national and community conservation service opportunities, outdoor education and career training for youth. SCA volunteers and interns annually perform more than one million hours of conservation service in national parks, forests, refuges, and urban areas in all 50 states.

Address: The Student Conservation Association (SCA)
PO Box 550
Charlestown, NH 03603
Phone: 603-543-1700

Program: Earth Force

Description: Earth Force is youth-driven with a national Youth Advisory Board (YAB) made up of 15 members, ages 10-17. The YAB helps develop and implement Earth Force programs. Through Earth Force, youth discover and implement lasting solutions to environmental issues in their community. In the process they develop life-long habits of active citizenship and environmental stewardship. Educators turn to Earth Force for innovative tools to engage young people in community problem solving.

Address: Earth Force
1908 Mt. Vernon Ave
2nd Floor
Alexandria, VA 22301
Phone: 703-299-9400

FOR MORE INFORMATION ON THE ENVIRONMENTAL JUSTICE AND ENVIRONMENTAL EDUCATION ISSUES DISCUSSED IN THIS CHAPTER, CONSULT THE FOLLOWING SOURCES USED IN THIS ASSESSMENT...

- *Bicycle Advocacy Report Card—Bikes Belong Coalition, Ltd.*
Website at <<http://bikesbelong.org/site/page>>
- *City of Springfield Department of Public Works, 2001 City Tree Inventory*
Website at <<http://www.ci.springfield.mo.us/egov/publicworks>>
- *Green Teacher: Education For Planet Earth (A Teaching Resource Journal)*
- *The Journal of Environmental Education*
- *The National Service-Learning Clearinghouse*
Website at <<http://www.servicelearning.org/res/faqs/faqs.htm>>
- *Office of Environmental Justice Resource Materials and Publications, EPA Office of Enforcement and Compliance Assurance*
Website at <<http://es.epa.gov/oeca/main/ej/publis.html>>
- *Report Assessing Environmental Education in the United States and the Implementation of the National Environmental Education Act of 1990. Report written in 1996.*
Available at <<http://www.epa.gov/enviroed/pdf/report.pdf>>

Environmental Indicators: Focus Areas for Environmental Health Improvement

One important purpose of this assessment is to shed light upon key environmental concerns in Springfield and Greene County. These concerns are considered some of the most important environmental issues in the County. Because of their importance, these environmental concerns will serve as focus areas to be annually assessed, tracked, and monitored through various indicators. This chapter identifies several indicators that will prove useful in diagnosing the environmental health of Springfield and Greene County. In addition to these, other environmental indicators will be identified in a series of public hearings to be facilitated by the Springfield-Greene County Environmental Advisory Board and the Environmental Collaborative of the Community Partnership of the Ozarks. Once the indicators have been determined, plans will be set in motion for monitoring the indicators and reporting on them annually in an environmental report card.

Testing for *E. coli* in Greene County streams

To date, *E. coli* data for Greene County streams have not been systematically collected. Through the assessment process, it was determined that monitoring *E. coli* levels in public access areas is important, especially since exposure to these bacteria can prove harmful to human health. As a result, Greene County officials have decided to initiate systematic monitoring of various public access areas. The James River and, possibly, the Little Sac River, will be monitored to determine if water access areas meet state standards for full-body contact.

Fish tissue analyses

Fish tissue analyses are regularly conducted throughout Missouri by the Department of Conservation. Tissue analyses are used to detect the presence of mercury, chlordane, and other contaminants in fish. Fish tissue analysis is typically administered on largemouth bass, as well as a few other species. Report card data will be obtained using results of the Department of Conservation's fish tissue analyses for Greene County waters.

Groundwater level testing using deep wells

Groundwater level testing has become an important issue in Greene County since groundwater levels have declined over recent decades. For the purposes of an annual report card, groundwater level measures will be obtained from the Missouri Department of Natural Resources' monitoring data. DNR maintains an observation well network that measures water levels. In all likelihood, groundwater levels will also be measured by a few newly constructed private wells in Greene County.

Waterborne Illnesses

The Springfield-Greene County Health Department monitors cryptosporidiosis and giardiasis. These two waterborne illnesses will continue to be monitored on an annual basis. These monitoring results will be reported in future Greene County environmental health reports.

Boil orders issued by the Missouri Department of Natural Resources

Another item to be discussed in annual report cards is the issuance of boil orders by the Missouri Department of Natural Resources. Boil orders are issued when a microbiological threat exists in a water supply. The report card will identify those locales where boil water orders were issued.

Macroinvertebrate studies

Studies on the macroinvertebrate population of Greene County streams have been conducted for several years. City Utilities has been the primary entity conducting these studies. The population of macroinvertebrates in a stream provides an indication of the health of a stream. Larger, diverse populations of macroinvertebrates indicate that a stream is healthy. The report card will discuss the results of yearly macroinvertebrate studies on streams throughout Greene County.

Well water test results

For future report cards, results of well water tests conducted by the Springfield-Greene County Health Department will be given. Bacteriological analyses are administered on wells in order to detect the presence of coliform bacteria in wells. For the report card, information on well water analyses will discuss the number of tests conducted, as well as the results of those tests.

Water quality

For the purposes of future assessments, both spring water quality and stream water quality will be reported annually. A collaboration of several entities will be working to collect and report on these water quality issues. These entities include the Springfield-Greene County Health Department, City Utilities, the Watershed Committee of the Ozarks, the James River Basin Partnership, and Springfield Public Works. In the past, spring water testing has involved measuring spring temperature, dissolved oxygen levels, nitrate levels, phosphorous levels, and the existence of *E. coli*. Stream water reporting will involve reports of fish kills, toxic spills, and bacteria in Greene County.

Community well chemistry

Public water systems provide water to at least 15 service connections, or serve an average of 25 people for at least 60 days per year. The Missouri Department of Natural Resources annually reports on water quality for county public/community wells. The annual report card will present the results of these community well tests. As discussed in the water quality section of this assessment, there are three types of public water system violations: acute maximum contaminant level (MCL) violations, non-acute MCL violations, and chronic monitoring violations.

Air pollution monitoring

The EPA, Missouri Department of Natural Resources, and the Springfield-Greene County Health Department monitor air quality for several pollutants. Using the data gathered by these entities, the report cards will provide annual air pollution monitoring information. Using current monitoring models, annual air pollution information will be compared to determine how Greene County is trending with respect to its air quality.

Recycling volume

Another issue to be discussed in the annual environmental report card is recycling. The report card will discuss the recycling volume processed in Springfield and Greene County. Assessments will report on the volume of all materials recycled in the community.

Pounds of household hazardous waste

The Household Chemical Collection Center tracks the amount of materials it takes in and recycles. Since 1996, for example, the HCCC has collected 528,000 pounds of materials, over 85 percent of which were recycled. The annual environmental report card will show figures on the pounds of waste collected by HCCC.

Blood lead levels

The Missouri Department of Health provides annual county data on elevated blood lead levels. Blood lead levels will continue to be monitored and will serve as another item to be reported in the annual environmental report card.

Environmental Education Numbers

Many of the agencies and organizations providing environmental education opportunities on a local and regional basis maintain attendance data of children and adults served during programs and events. This data could be more formally tracked and compiled, and would thereby serve as an additional indicator in the annual environmental report card.